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KIMBALL (L ROBERT) AND ASSOCIATES EBENSBURG PA

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NATIONAL DAM INSPECTION PROGRAM. MIDDLE CREEK DAM, CLARENCE F. --ETC(U)

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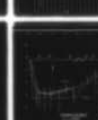
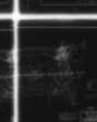
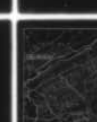
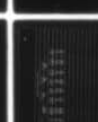
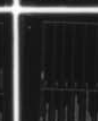
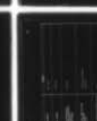
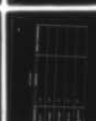
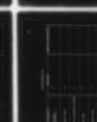
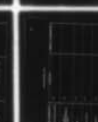
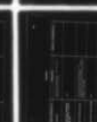
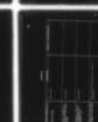
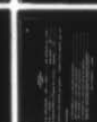
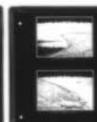
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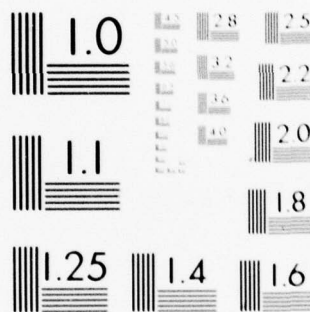
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SUSQUEHANNA RIVER BASIN  
MIDDLE CREEK, SNYDER COUNTY

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PENNSYLVANIA  
**MIDDLE CREEK DAM**  
**CLARENCE F. WALKER LAKE**

NDS ID NO. PA-00918

DER ID NO. 55-45

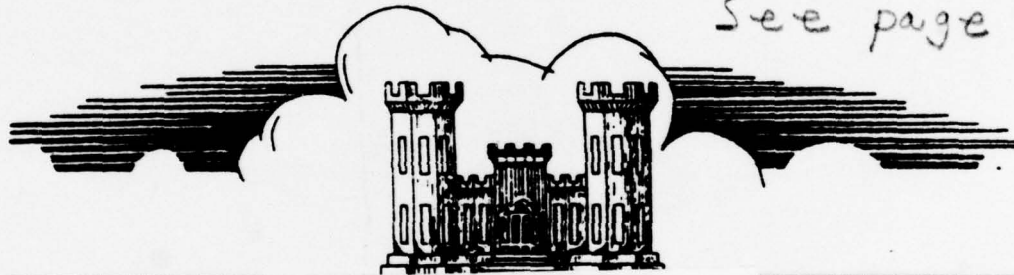
SCS ID NO. PA 637

**LEVEL**

PENNSYLVANIA FISH COMMISSION

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

*See page ii.*



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Prepared By

**L. ROBERT KIMBALL & ASSOCIATES**  
CONSULTING ENGINEERS & ARCHITECTS  
EBENSBURG, PENNSYLVANIA  
15931

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DEPARTMENT OF THE ARMY  
BALTIMORE DISTRICT CORPS OF ENGINEERS  
BALTIMORE, MARYLAND

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APRIL, 1979

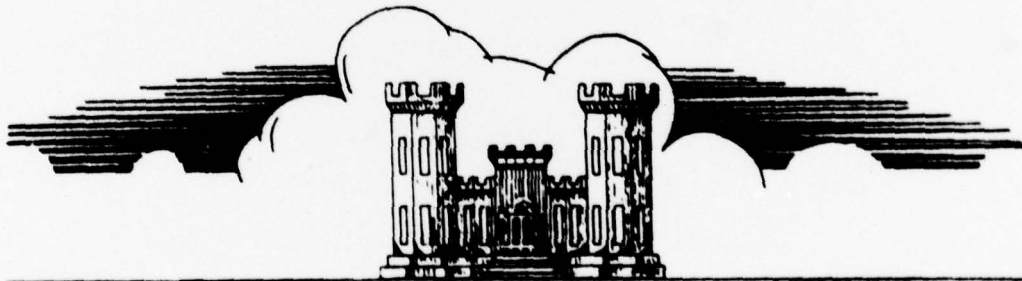
SUSQUEHANNA RIVER BASIN  
MIDDLE CREEK, SNYDER COUNTY

PENNSYLVANIA  
**MIDDLE CREEK DAM**  
**CLARENCE F. WALKER LAKE**

NDS ID NO. PA-00918  
DER ID NO. 55-45  
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PENNSYLVANIA FISH COMMISSION

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM



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## PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT  
NATIONAL DAM INSPECTION REPORT

NAME OF DAM: Middle Creek Dam  
STATE LOCATED: Pennsylvania  
COUNTY LOCATED: Snyder  
STREAM: North Branch of Middle Creek  
DATE OF INSPECTION: November 9, 1978

(6) National Dam Inspection Program, Middle Creek Dam, Clarence F. Walker Lake (NDS ID Number PA-00918, DER ID Number 55-45, SCS ID Number PA-637), Susquehanna River Basin, Middle Creek,

Snyder County, Pennsylvania. Phase I Inspection Report.

11 Apr 79

ASSESSMENT

The assessment of Middle Creek Dam is based upon visual observations made at the time of inspection, review of available records and data, hydrologic and hydraulic computations, and past operational performance.

12 97 P  
The embankment and appurtenant structures appear to be in good condition and well maintained. However, the presence of the seepage zones and wet areas are of concern. The long term effect of these areas on the stability of the embankment is unknown.

Countd FROM P. 1  
The existing spillways and reservoir are capable of controlling the PMF (probable maximum flood). Based upon criteria established by the Corps of Engineers, the spillway is termed adequate.

The following recommendations should be instituted immediately:

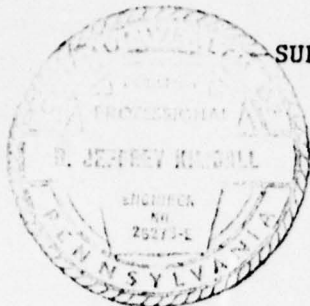
1. The wet areas and seeps should be surveyed for location and elevation at regular intervals. Weirs should be installed to measure the quantity of flow. Water samples of the seepage should be tested for turbidity at regular intervals. If flow increases, water is turbid, or size and location changes, a detailed study should be made at once and remedial measures taken.

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The services of a professional engineer knowledgeable in dam design should be retained to evaluate the effect of the seepage. During the study the use of piezometers may be warranted to verify the phreatic surface.

2. A warning system should be developed to warn downstream residents of large spillway discharges or failure of the dam and during periods of heavy rainfall or high runoff.

3. Access to the dam should be improved so the dam is accessible during periods of flooding.



SUBMITTED BY: L. ROBERT KIMBALL AND ASSOCIATES  
CONSULTING ENGINEERS AND ARCHITECTS

R Jeffrey Kimball  
R. Jeffrey Kimball, P.E.

4/18/79  
Date

K. Chuang  
Kuang-hwei Chuang, P.E.

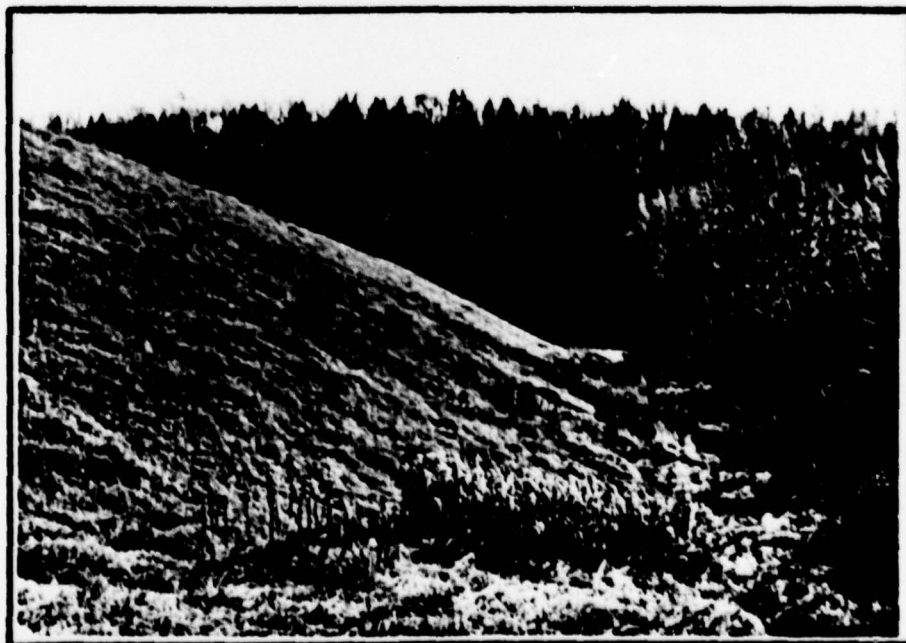
APPROVED BY:

17 May 79  
Date

G. W. Withers  
G. W. WITHERS  
Colonel, Corps of Engineers  
District Engineer



Overview of upstream slope.



Overview of downstream slope.

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PHASE I  
NATIONAL DAM INSPECTION PROGRAM  
MIDDLE CREEK DAM  
NDI I.D. NO. PA 918  
DER I.D. NO. 55-45

SECTION 1  
PROJECT INFORMATION

1.1 General.

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspecting dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Middle Creek Dam (Clarence F. Walker Lake) is a zoned earthfill dam. The embankment is 53 feet high and 1360 feet long. The axis of the dam has a 137° bend in the upstream direction 860 feet from the left abutment. The upstream slope is 3H:1V and has two benches. Riprap is present only on the middle portion of the upstream slope (See Figure 4, Appendix E). The downstream slope is 2H:1V. The cutoff trench averages 25 feet wide and is carried to rock. On both abutments, the trench narrows and is not carried to rock. In the center portion of the cutoff trench, there is a perforated drain pipe (See Figures 7 and 8, Appendix E). The embankment contains three zones of material: clay, gravely silt or clay and siltstone or shale. The emergency spillway is located on the right (north) abutment. The spillway is 170 feet wide and is open cut in shale and weathered shale. The approach channel is 400 feet long and the discharge channel is 330 feet long. The left side slope is 2H:1V and has a separator dike so that discharges from the spillway are deflected away from the toe of the dam embankment. The separator dike also serves as an access road to the top of the dam embankment. The principal spillway consists of 48 inch concrete pipe with a reinforced concrete riser inlet. Extending upstream of the riser is a 36 inch concrete pipe with a reinforced concrete reservoir drain inlet at the upstream toe of the embankment. At the downstream end of the 48 inch diameter pipe is a concrete impact stilling basin. →

b. Location. The dam is located on the North Branch of Middle Creek, approximately 1/2 mile southeast of Troxelville, Snyder County, Pennsylvania. Middle Creek Dam can be located on the Beavertown, Pennsylvania, U.S.G.S. 7.5 minute quadrangle. [CONT'D ON P. 11]

c. Size Classification. Middle Creek Dam is an intermediate size structure (53 feet high, 11,600 acre-feet).

d. Hazard Classification. Middle Creek Dam is a high hazard dam. Downstream conditions indicate that loss of more than a few lives is probable should the structure fail.

e. Ownership. Middle Creek Dam is owned by the Commonwealth of Pennsylvania. Correspondence should be addressed to:

Bureau of Fisheries and Engineering  
Pennsylvania Fish Commission  
Commonwealth of Pennsylvania  
Robinson Lane  
Bellfonte, Pennsylvania 16823

f. Purpose of Dam. Middle Creek Dam is used for recreation and flood control.

g. Design and Construction History. The dam was designed and constructed by the United States Department of Agriculture, Soil Conservation Service. Construction was initiated in 1969 and completed in 1970 by Trindle Construction, Inc. of Carlisle, Pennsylvania.

h. Normal Operating Procedure. Middle Creek Dam is designed to control flow automatically. The principal spillway is a rectangular shaped reinforced concrete vertical riser, 12 x 4 feet, with a crest elevation of 634.90. During normal flows, a conservation pool elevation of approximately 635.4 will be automatically maintained. It is not possible to manually control flows through the principal spillway; therefore, a resident dam tender is unnecessary.

### 1.3 Pertinent Data.

a. Drainage Area. 17.6 square miles

b. Discharge at Dam Site (cfs).

Maximum known flood at dam site	June 1972, level unknown
Warm water outlet at pool elevation	Variable
Drain line (36") low pool outlet	
at pool elevation	Unknown
Gated spillway capacity	N/A
Principal spillway capacity at top	
of dam elevation	406
Emergency spillway capacity at top	
of dam elevation	28,574
Total spillway capacity at top of	
dam elevation	28,980

c. Elevation (U.S.G.S. Datum) (Feet).

Top of dam - Field Survey	657.6
Design top of dam	657.1
Maximum pool - design surcharge	656.0

Full flood control pool	657.1
Recreational pool	Approximately 635.4
Principal spillway crest	634.9
Emergency spillway crest	643.6
Upstream portal-36" drain line	607.5
Downstream portal-48" principal spillway line	602.5
Streambed at centerline of dam	602.5
Maximum tailwater	None
d. <u>Reservoir (feet).</u>	
Length of maximum pool	17,000
Length of normal pool	13,000
Length of flood control pool	17,000
e. <u>Storage (acre-feet).</u>	
Normal pool	2753
Flood control pool	11,600
Design surcharge	10,000
Top of dam	11,600
f. <u>Reservoir Surface (acres).</u>	
Top of dam	615
Maximum pool	615
Flood control pool	615
Normal pool	239
Emergency spillway crest	370
g. <u>Dam.</u>	
Type	Earthfill
Length	1360 feet
Height	53 feet
Top width	18 feet
Side slopes	Upstream 3H:1V
	Downstream 2H:1V
Zoning	Yes
Impervious core	None
Cutoff	Yes, core trench
Grout curtain	None
h. <u>Reservoir Drain.</u>	
Type	36" concrete pipe
Length	264 feet
Closure	Sluice gate
Access	Only when reservoir is drained
Regulating facilities	Screw stem on upstream slope

i. Emergency spillway.

Type	Open channel
Length	170 feet
Crest elevation	643.6
Gates	None
Upstream channel	400' open cut channel
Downstream channel	330' open cut channel

## SECTION 2 ENGINEERING DATA

2.1 Design. Review of information in the files of the Commonwealth of Pennsylvania, Department of Environmental Resources (PennDER); the Pennsylvania Fish Commission; and the U.S. Department of Agriculture, Soil Conservation Service (SCS) revealed that considerable engineering data are available for review. The majority of the design data were obtained from the SCS. The information reviewed for this study included hydraulics and hydrology, filter design, seepage analysis, geologic reports, and summary of stability analyses.

2.2 Construction. The SCS files contain detailed data on the construction of the dam.

2.3 Operation. No formal operating records are maintained.

2.4 Evaluation.

a. Availability. Engineering data were provided by PennDER, Bureau of Dam Safety, Obstructions and Storm Water Management; the Pennsylvania Fish Commission; and the SCS. Three representatives of the Pennsylvania Fish Commission accompanied the inspection team.

b. Adequacy. The type and amount of design data and other engineering information is substantial. The information available is sufficient to complete a Phase I Report.

SECTION 3  
VISUAL INSPECTION

3.1 Findings.

a. General. The onsite inspection of Middle Creek Dam was conducted by personnel of L. Robert Kimball and Associates accompanied by Fish Commission staff on November 9, 1978. The inspection consisted of:

1. Visual inspection of the retaining structure, abutments and toe.
2. Examination of the spillway facilities, exposed portions of any outlet works, and other appurtenant works.
3. Observations affecting the runoff potential of the drainage basin.
4. Evaluation of the downstream area hazard potential.

b. Dam. The dam appears to be in good condition. The dam appears to conform closely to the construction drawings. From a brief on site survey it was determined that no low spots below the design top of dam were present. Both the upstream and downstream slopes appeared to be in good condition. The upstream slope had riprap to approximately elevation 639.5. Above the riprap the slope was grassed. The downstream slope was entirely grassed. Several seepage zones were noted on the downstream slope. One zone is located approximately 30 feet left of the impact basin. This area is approximately 7 feet wide at the top (elevation 617.7) and 10 feet wide at the toe. The second area is 122 feet right of the impact basin and 14 feet wide at the top (elevation 617.7) and 33 feet wide at the toe. Minimal flow was noted at each area. See page A-12 for location.

Beyond the toe of embankment near the left abutment there are several wet areas and seepage area. Water was bubbling from the ground in one area. No soil particles were noted in the bubbling water. At a location where the seepage is confined in a channel it was determined that 28 gpm was discharging from the seepage zones.

The perforated drain pipe in the cutoff trench discharges through the side walls of the impact basin. The left drain was producing approximately 10 gpm while the right one was producing less than 1 gpm.

c. Appurtenant Structures. The reservoir level at the time of inspection was approximately 635.4. About 6 inches of water was discharging over the principal spillway. The inlet structure appeared to be in very good condition. During the inspection the sluice gate on the 36 inch drain was opened for several minutes. The condition of the 36 inch and 48 inch conduits was unobserved. The impact basin was in good condition.

The emergency spillway was in good condition. The bottom and side slopes were grassed. The concrete sill was in good condition.

d. Reservoir Area. The watershed is predominantly woodland and farmland. The reservoir slopes are not considered to be susceptible to massive landslides which would affect storage volume of the reservoir or overtopping of the dam by displacing water.

e. Downstream Channel. North Branch has a moderately wide channel before entering Middle Creek. The floodplain supports farming with a considerable amount of woodland present. The first downstream residence is about 700 feet beyond the toe of the embankment. This residence would be affected by large discharges from the emergency spillway. Approximately 3000 feet downstream are a group of eight residences which are along the stream channel.

3.2 Evaluation. The visual inspection did not reveal any serious and immediate concerns. In general, the embankment and appurtenant structures appear to be in very good condition and well maintained. The seepage and wet areas should be further investigated to determine their long term effect.

SECTION 4  
OPERATIONAL PROCEDURES

4.1 Procedures. The reservoir is maintained at a minimum water level of 634.9 (principal spillway crest). Excess inflow is discharged through the emergency spillway automatically. The drain line is opened twice a year. The spillway channel is mowed twice each year. No other operational procedures are conducted.

4.2 Maintenance of the Dam. No planned maintenance schedule is utilized. All maintenance is performed on an as-needed basis. Minor work such as mowing grass is performed by Fish Commission staff. Major work is contracted. Maintenance of the dam is considered good.

4.3 Maintenance of Operating Facilities. Maintenance of the operating facilities are performed by Fish Commission staff. The drain line and mowing of the spillway channel grass is performed twice a year. The Commonwealth of Pennsylvania has an Operation and Maintenance Manual for Middle Creek Dam.

4.4 Warning System in Effect. There is no formal warning system in effect to warn downstream residents of high discharges or failure of the dam. The Fish Commission does have an emergency plan for the dam.

4.5 Evaluation. The operational procedures for the dam and appurtenant structures is considered good. There is no warning system in effect for the dam. The dam is essentially inaccessible by automobile during flooding.

SECTION 5  
HYDROLOGY AND HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. Hydrology and hydraulic information contained in the SCS files is considerable. The principal spillway, emergency spillway, and freeboard hydrographs were routed using the SCS method (25 inches of rain in a 6 hour duration). A peak discharge of 25,000 cfs was calculated at a maximum water level of 656 (top of dam is 657.6).

b. Experience Data. No rainfall, runoff or reservoir level data were available. The spillway has reportedly functioned adequately in the past. There was some erosion in the spillway channel from the June, 1972 discharge.

c. Visual Observations. Both the principal and emergency spillways are in good condition and well maintained.

d. Overtopping Potential. Overtopping potential was investigated through the development of the probable maximum flood (PMF) for the watershed and the subsequent routing of the PMF and fractions of the PMF through the reservoir and spillway.

The Corps of Engineers, Baltimore District, has directed that the HEC-1 Dam Safety Version systemized computer program be utilized. The program was prepared by the Hydrologic Engineering Center (HEC) U.S. Army Corps of Engineers, Davis, California, July, 1978. The major methodologies or key input data for this program are discussed briefly in Appendix D.

5.2 Evaluation Assumptions. To enable us to complete the hydraulic and hydrologic analysis for this structure, it was necessary to make the following assumptions.

1. The initial water level before flood is elevation 634.9 (principal spillway crest).

2. Flow through both the principal spillway and emergency spillway is maintained.

5.3 Summary of Overtopping Analysis. Complete summary sheets from the computer output are presented in Appendix D.

Peak Inflow	20,215 cfs
Spillway Capacity	94,962 cfs

a. Spillway Adequacy Rating. The Spillway Design Flood (SDF) for this dam is the PMF. The SDF is based upon the hazard and size classification. Based on the following definition provided by the Corps of Engineers the spillway for this dam is rated as adequate as a result of our hydrologic analysis.

Adequate - For intermediate size dams the spillway and reservoir can safely pass the PMF.

Middle Creek Dam's spillway and reservoir are capable of controlling the PMF (4.85' of freeboard remaining).

Note: Future development within the watershed, at the dam, or downstream may change the characteristics and assumptions made for this study and different results are likely. Future development downstream may also greatly increase the potential for loss of life due to failure of the structure.

SECTION 6  
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. Visual inspection did not reveal any signs of immediate instability. However, the wet areas and seeps if untreated may become more serious with time. The long term effect of these features is uncertain. The dam appears to conform to the construction drawings. .

b. Design and Construction Data. The embankment stability was calculated by the SCS with a circular arc and sliding block method. The analyses reportedly revealed sufficient safety factors. No safety factors were available for review.

c. Operating Records. There are no operating records of the dam.

d. Past-Construction Changes. There have been no post-construction changes to the dam or appurtenant structures.

e. Seismic Stability. The dam is located in seismic zone 1. No seismic stability analysis has been performed. Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake loading.

SECTION 7  
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The dam appears to be in good condition. The visual observations, review of available information, hydrologic calculations, and past operational performance indicate that Middle Creek Dam's spillway is adequate. The spillway is capable of handling the PMF without overtopping. The long term effect of the seepage zones and wet areas on the stability of the structure is uncertain.

b. Adequacy of Information. Sufficient information is available to complete a Phase I Report.

c. Urgency. The recommendations suggested below should be implemented immediately.

d. Necessity for Further Investigations. In order to accomplish some of the recommendations/remedial measures outlined below, further investigations will be required.

7.2 Recommendations/Remedial Measures.

1. The wet areas and seeps should be surveyed for location and elevation at regular intervals. Weirs should be installed to measure the quantity of flow. Water samples of the seepage should be tested for turbidity at regular intervals. If flow increases, water is turbid, or size and location changes a detailed study should be made at once and remedial measures taken.

The services of a professional engineer knowledgeable in dam design should be retained to evaluate the effect of the seepage. During the study the use of piezometers may be warranted to verify the phreatic surface.

2. A warning system should be developed to warn downstream residents of large spillway discharges or failure of the dam and during periods of heavy rainfall or high runoff.

3. Access to the dam should be improved so the dam is accessible during periods of flooding.

APPENDIX A

CHECKLIST, VISUAL INSPECTION, PHASE I

CHECK LIST  
VISUAL INSPECTION  
PHASE I

NAME OF DAM Middle Creek Dam COUNTY Snyder STATE Pennsylvania ID# PA 918  
 TYPE OF DAM Earthfill HAZARD CATEGORY High  
 DATE(s) INSPECTION November 9, 1978 WEATHER Clear, cool windy TEMPERATURE 60°F

POOL ELEVATION AT TIME OF INSPECTION 635.4 approx M.S.L. TAILWATER AT TIME OF INSPECTION None M.S.L.

INSPECTION PERSONNEL:

R. Jeffrey Kimball, P.E. - L. Robert Kimball and Associates  
James T. Hockensmith - L. Robert Kimball and Associates  
James A. Kuncelman - L. Robert Kimball and Associates  
E. Jon Grindall, P.E. - Senior Project Engineer Fish Commission  
Danny O'Neill - Chief Property Maintenance, Pennsylvania Fish Commission  
Charles Hess - Area Maintenance Manager, Pennsylvania Fish Commission

James T. Hockensmith RECORDER

# EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None noted.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None noted.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None noted.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Vertical and horizontal good. Axis has a 137° bend.	
RIPRAP FAILURES	None.	

# EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATION	Grasses and crown vetch. Wet areas have high grass and cattails.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good.	
ANY NOTICEABLE SEEPAGE	Two wet areas at elevation 617.7 on downstream slope (flow minimal). Several seepage zones and boils at/ir beyond downstream toe (28 gpm).	
STAFF GAUGE AND RECORDER	None.	
DRAINS	Both key trench drains producing water. Left drain (10 gpm), Right drain (1 gpm).	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	N/A	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N/A	
DRAINS	N/A	
WATER PASSAGES	N/A	
FOUNDATION	N/A	

# CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	N/A	
STRUCTURAL CRACKING	N/A	
VERTICAL AND HORIZONTAL ALIGNMENT	N/A	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	N/A	
STAFF GAUGE OR RECORDER	N/A	

# OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Unobservable.	
INTAKE STRUCTURE	In good condition (principal spillway). Inlet or drain unobserved but operated.	
OUTLET STRUCTURE	Impact basin in good condition.	
OUTLET CHANNEL	Good condition. Riprap immediately below impact basin.	
EMERGENCY GATE	Reservoir drain 36" pipe with sluice gate.	

# UNCATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Broad crested weir with a 3' wide concrete sill flush with the earth.	
APPROACH CHANNEL	400' long open cut channel - good condition, grassed.	
DISCHARGE CHANNEL	330' long open cut channel - good condition, grassed.	
BRIDGE AND PIERS	None.	

# GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE AND PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

# DOWNSTREAM CHANNEL

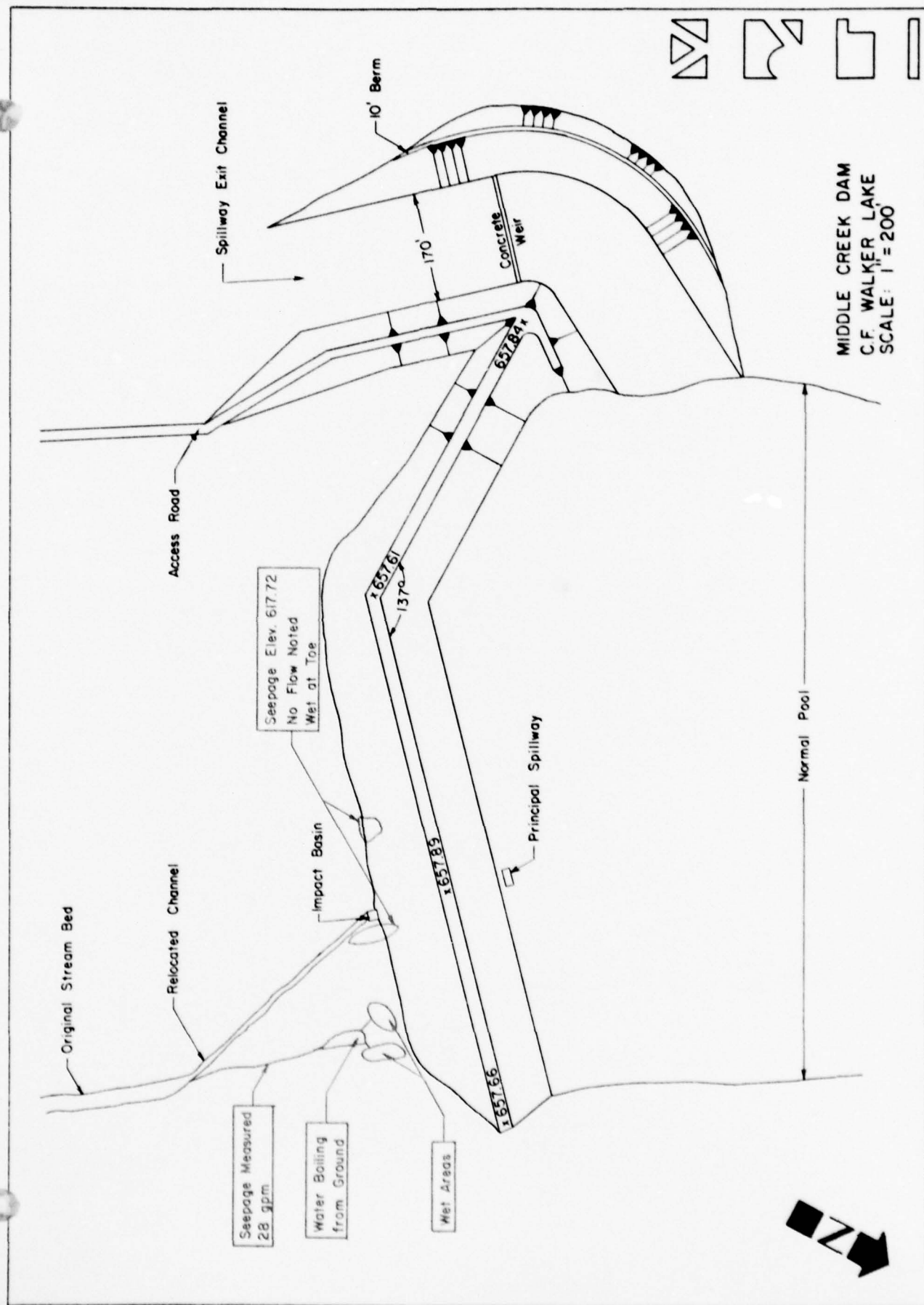
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Natural stream. Moderately wide floodplain. Farming and woodland.	
SLOPES	Gentle to moderate.	
APPROXIMATE NO. OF HOMES AND POPULATION	Approximately 10 homes (40 people).	

# RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Moderately steep. Stable.	
SEDIMENTATION	Does not appear to be excessive.	

# INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	Monument on each abutment.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER		



MIDDLE CREEK DAM  
C.F. WALKER LAKE  
SCALE: 1" = 200'

APPENDIX B

CHECKLIST, ENGINEERING DATA, DESIGN, CONSTRUCTION, OPERATION, PHASE I

**CHECK LIST  
ENGINEERING DATA  
DESIGN, CONSTRUCTION, OPERATION  
PHASE I**

NAME OF DAM Middle Creek Dam

ID# PA 918

ITEM	REMARKS
AS-BUILT DRAWINGS	None.
REGIONAL VICINITY MAP	On construction drawings.
CONSTRUCTION HISTORY	SCS files.
TYPICAL SECTIONS OF DAM	Construction drawings.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS RAINFALL/RESERVOIR RECORDS	Construction drawings. SCS files None.

ITEM	REMARKS
DESIGN REPORTS	SCS files.
GEOLOGY REPORTS	SCS files.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	SCS files.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Construction drawings. SCS files
POST-CONSTRUCTION SURVEYS OF DAM	None.
BORROW SOURCES	Construction drawings.

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	None.
HIGH POOL RECORDS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None.
MAINTENANCE OPERATION RECORDS	None.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	Construction drawings.
OPERATING EQUIPMENT PLANS & DETAILS	Construction drawings.

APPENDIX C  
PHOTOGRAPHS



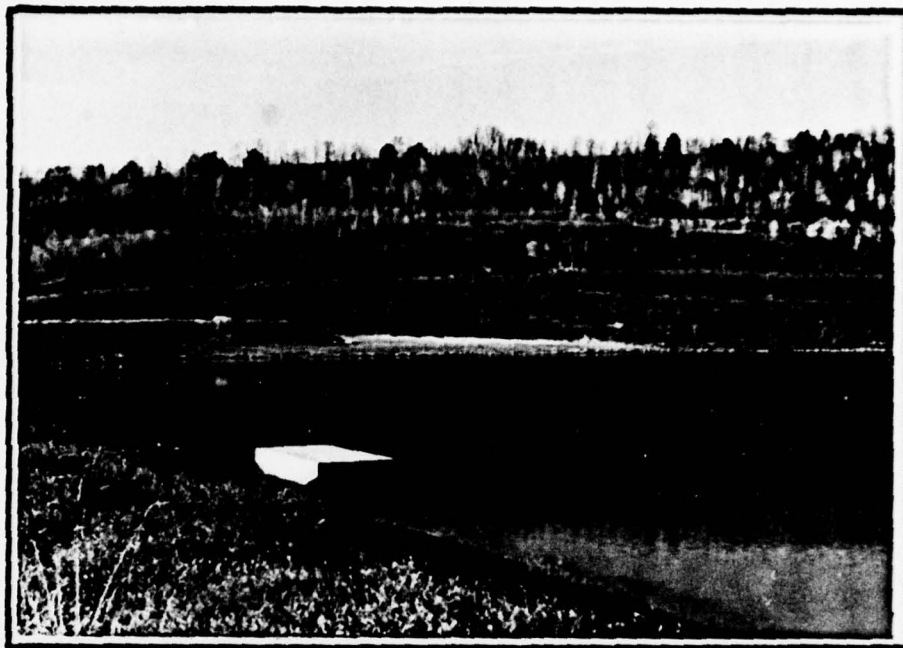
Photograph No. 1

Downstream slope. Top of wet area where men are standing.



Photograph No. 2

Downstream slope. Wet in high grassed areas.



Photograph No. 3

Emergency spillway entrance.



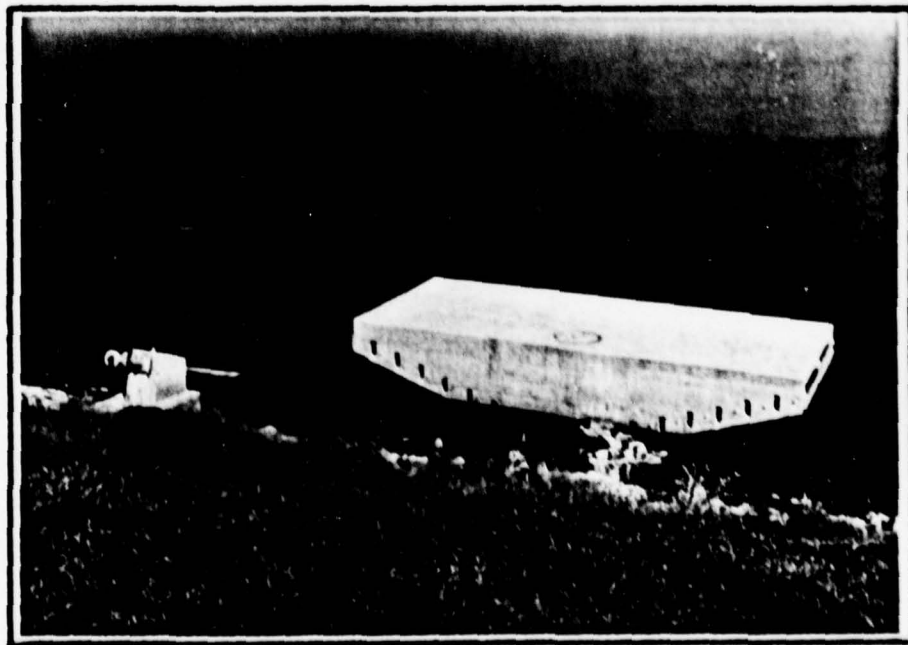
Photograph No. 4

Weir and control section in emergency spillway.



Photograph No. 5

Spillway exit channel.



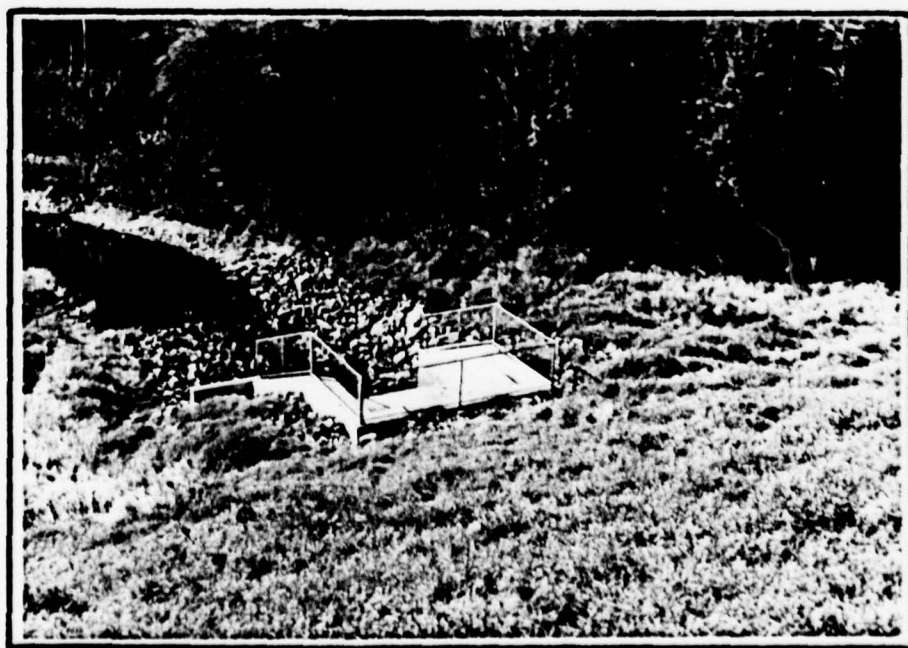
Photograph No. 6

Principal spillway and controls.



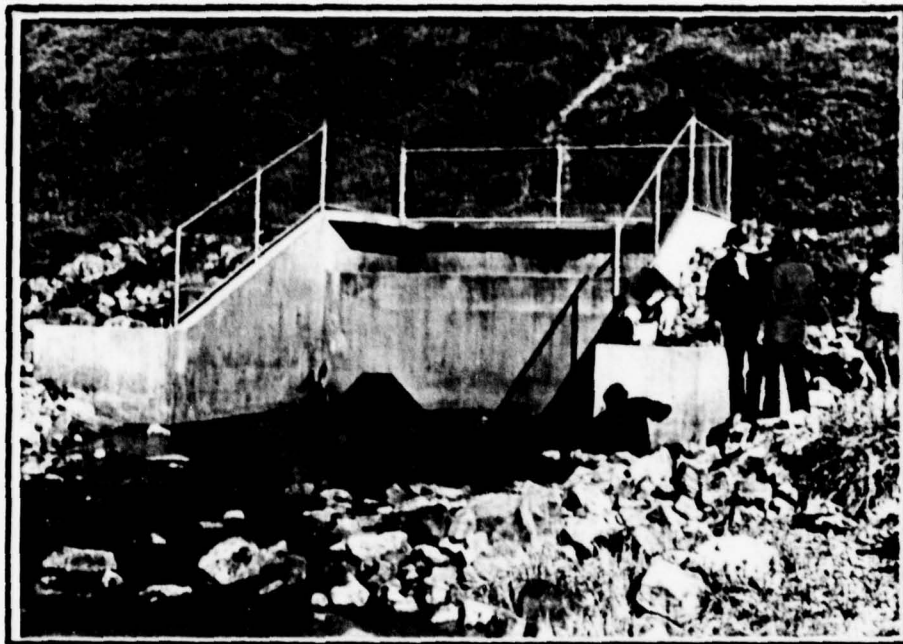
Photograph No. 7

Principal spillway inlet.



Photograph No. 8

Impact basin.



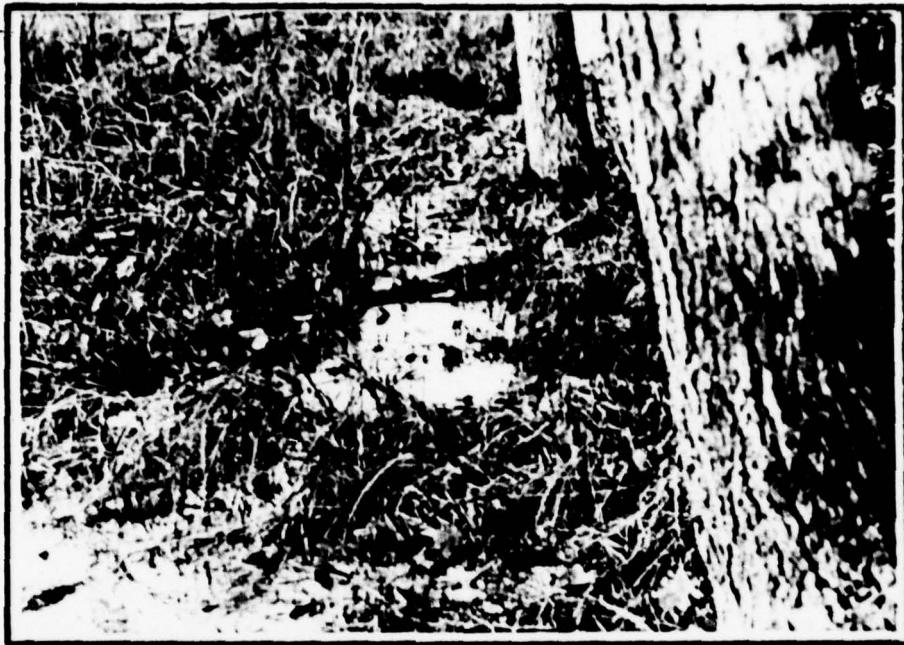
Photograph No. 9

Impact basin.



Photograph No. 10

Wet area at toe near left abutment. Water boiling at tip of rule.



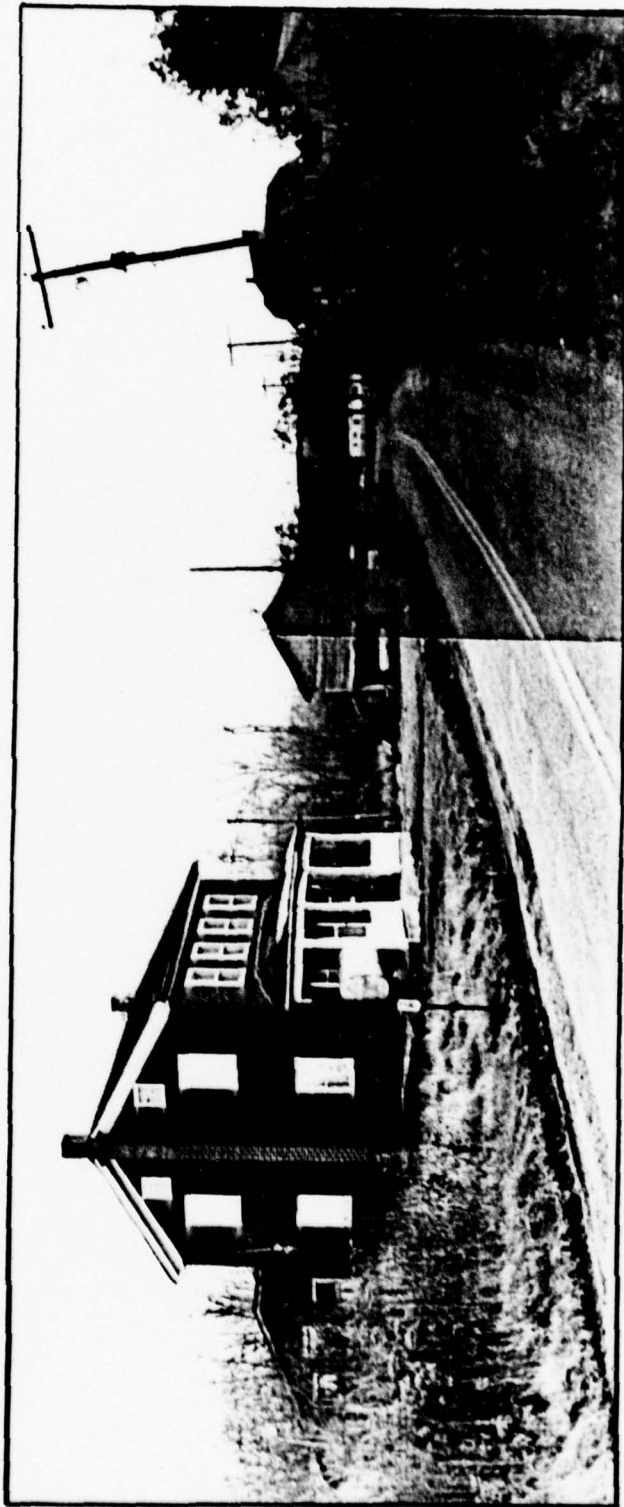
Photograph No. 11

Wet area at toe immediately adjacent to downstream toe.



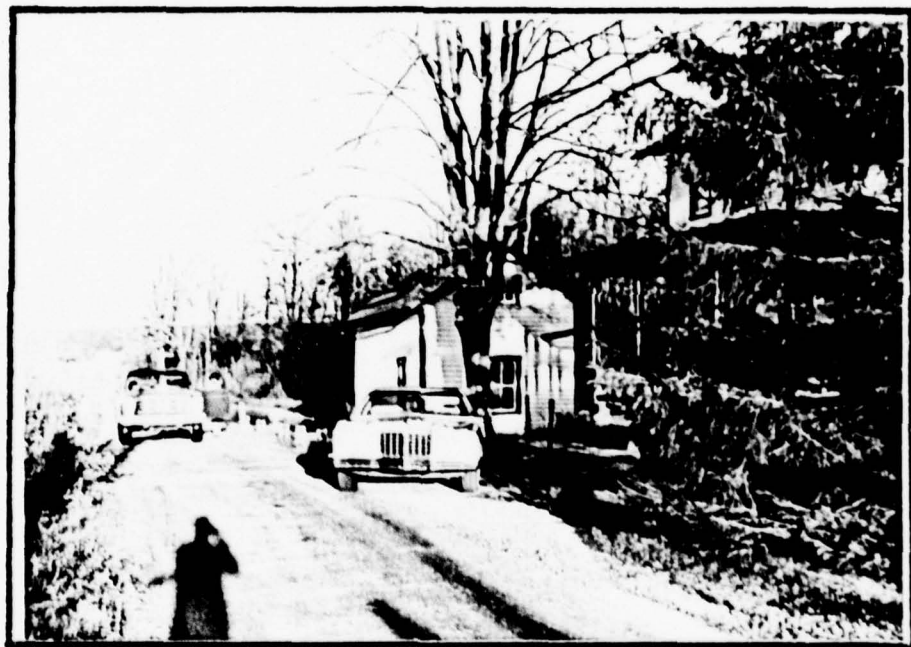
Photograph No. 12

Measuring seepage below boils.



Photograph No. 13

Dwellings along road adjacent to Middle Creek downstream.



Photograph No. 14

First dwelling downstream - right section of dam visible in background.

APPENDIX D  
HYDROLOGY AND HYDRAULICS

APPENDIX D  
HYDROLOGY AND HYDRAULICS

Methodology. The dam overtopping analysis was accomplished using the systemized computer program HEC-1 (Dam Safety Version). July, 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. A brief description of the methodology used in the analysis is presented below.

1. Precipitation. The Probable Maximum Precipitation (PMP) is derived and determined from regional charts prepared from past rainfall records including "Hydrometeorological Report No. 40 prepared by the National Weather Service.

The index rainfall is reduced from 10% to 20% depending on watershed size by utilization of what is termed the HOP Brook adjustment factor. Distribution of the total rainfall is made by the computer program using distribution methods developed by the Corps.

2. Inflow Hydrograph. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for reservoir routing.

The unit hydrograph is developed using the Snyder method. This method requires calculation of several key parameters. The following list gives these parameters their definition and how they were obtained for these analysis.

Parameter	Definition	Where Obtained
$C_t$	Coefficient representing variations of watershed slope and storage	From Corps of Engineers*
$L$	Length of main stream channel, miles	From U.S.G.S. 7.5 minute topographic
$L_{ca}$	Length on main stream to centroid of watershed	From U.S.G.S. 7.5 minute topographic
$C_p$	Peaking coefficient	From Corps of Engineers*
$A$	Watershed size	From U.S.G.S. 7.5 minute topographic

\*Developed by the Corps of Engineers on a regional basis for Pennsylvania.

3. Routing. Reservoir routing is accomplished by using Modified Puls routing techniques where the flood hydrograph is routed through reservoir storage. Hydraulic capacities of the outlet works, spillways and the crest of the dam are used as outlet controls in the routing.

The hydraulic capacity of the outlet works can either be calculated and input or sufficient dimensions input and the program will calculate an elevation discharge relationship.

Storage in the pool area is defined by an area - elevation relationship from which the computer calculates storage. Surface areas are either planimetered from available mapping or U.S.G.S. 7.5 minute series topographic maps or taken from reasonably accurate design data.

4. Dam Overtopping. Using given percentages of the PMF the computer program will calculate the percentage of the PMF which can be controlled by the reservoir and spillway without the dam overtopping.



L. ROBERT KIMBALL & ASSOCIATES  
CONSULTING ENGINEERS & ARCHITECTS  
EBENSBURG PENNSYLVANIA

DAM NAME MIDDLE CREEK DAM

I.D. NUMBER PA. 55-45

SHEET NO. 1 OF 3

BY OTM DATE 2-15-79

### MIDDLE CREEK DAM

#### DRAINAGE AREA

AREA = 17.6 SQ. MI. { FROM U.S.G.S. QUADS. }

#### UNIT HYDROGRAPH PARAMETERS

DAM SITE LOCATED IN ZONE 18, SUSQUEHANNA  
RIVER BASIN. FROM CORPS. OF ENGINEERS,  
BALTIMORE DISTRICT REGIONAL STUDY.

$C_p = 0.50$  ,  $C_t = 2.10$  ,  $L = 6.8$  MILES ,  $L_c = 3.8$  MILES

$t_p = C_t (L \times L_c)^{0.3} = 2.10 (6.8 \times 3.8)^{0.3}$

$t_p = 2.1(2.65) = 5.57$  HRS. (SNYDEES LAG( $t_p$ ) IN HRS.)

#### LOSS RATE AND BASE FLOW PARAMETERS

AS RECOMMENDED BY CORPS. OF ENGINEERS,  
BALTIMORE DISTRICT.

STR TL = 1 INCH

CNST L = 0.05 IN./HR.

STR TQ = 1.50 cfs/SQ MI

QRCSN = 0.05 (5% OF PEAK FLOW)

RTIOR = 2.00

#### PROBABLE MAXIMUM STORM

FROM H.R. NO. 40

P.M.P. INDEX RAINFALL =  $22.2(1.05) = 22.8$  INCHES

$R_6 = 111\%$  ,  $R_{12} = 121\%$  ,  $R_{24} = 130\%$  ,  $R_{48} = 137\%$  ,  $R_{72} = 140\%$



L. ROBERT KIMBALL & ASSOCIATES  
CONSULTING ENGINEERS & ARCHITECTS  
EBENSBURG PENNSYLVANIA

DAM NAME MIDDLE CREEK DAM  
I.D. NUMBER PA. 55-45

SHEET NO. 2 OF 3  
BY OTM DATE 2-15-79

### ELEVATION-AREA-CAPACITY RELATIONSHIPS

#### PRINCIPAL SPILLWAY

CREST ELEVATION 634.9' - AREA = 239 ACRES

INITIAL STORAGE = 2,753 AC·FT

DATA FROM DESIGN PLAN, D.E.R. FILE

FROM U.S.G.S. QUAD.

ELEVATION 640', AREA = 312 ACRES

ELEVATION 660', AREA = 680 ACRES

THIS DATA COMPARED WITH AREA-CAPACITY

CURVE FROM D.E.R. FILE. DATA AGREED

WITH GIVEN INFORMATION.

FROM CONIC METHOD FOR RESERVOIR VOLUME.

FLOOD HYDROGRAPH PACKAGE (HEC-1). DAM

SAFETY VERSION (USERS MANUAL).

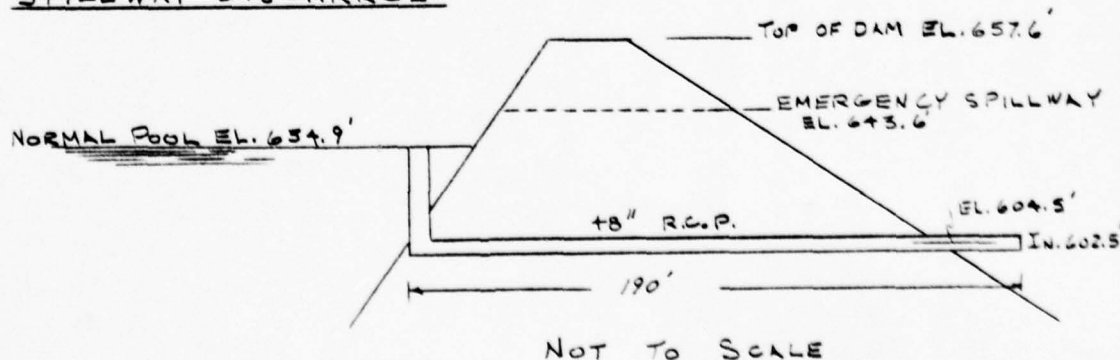
$$H = 3V/A = 3(2,753 \text{ AC·FT}) / 239 \text{ AC} = 34.56'$$

ELEVATION AT CAPACITY EQUALS ZERO,

$$634.9' - 34.56' = 600.34'$$

ELEV. (FT)	600.3	634.9	637	640	643	645	647	650	660
AREA. (AC)	0	239	270	312	360	400	440	500	680

### SPILLWAY DISCHARGE





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EBENSBURG PENNSYLVANIA

DAM NAME MIDDLE CREEK DAM

I.D. NUMBER PL. 55-45

SHEET NO. 3 OF 3

BY OTM DATE 2-19-79

# DISCHARGE

ELEV.  (FT.)	PRINCIPAL SPILLWAY				EMERGENCY SPILLWAY		DISCHARGE  (CFS)
	WEIR FLOW		FULL FLOW		H <sub>3</sub> (FT.)	Q <sub>3</sub> (CFS)	
	H <sub>1</sub> (FT.)	Q <sub>1</sub> (CFS)	H <sub>2</sub> (FT.)	Q <sub>2</sub> (CFS)			
634.9	0	0					
635.4	0.5	26					26
636.4	1.5	136					136
637.5	2.5	292					292
637.9			33.4	324			324
643.6			39.1	350			350
644.6			40.1	355	1	504	359
645.6			41.1	359	2	1440	1799
646.6			42.1	363	3	2671	3034
647.6			43.1	368	4	4152	4520
648.6			44.1	372	5	5858	6230
649.6			45.1	376	6	7773	8149
651.6			47.1	384	8	12193	12577
653.6			49.1	392	10	17358	17750
655.6			51.1	400	12	23237	23637
657.6			53.1	408	14	29812	30220
659.6			55.1	416	16	37074	37490
661.6			57.1	423	18	45017	45440
666.6			62.1	441	23	67849	68290
671.6			67.1	459	28	94962	95421

## PRINCIPAL SPILLWAY

A) WEIR FLOW  $Q_1 = C L H^{3/2}$  (USE  $C = 3.3$ )

B) FULL FLOW  $Q_2 = 2.7 \sqrt{\frac{2gH}{1 + K_e + K_b + K_{pl}}}$

## EMERGENCY SPILLWAY

A) TRAPEZOIDAL  $Q_3 = 8.03 C' h_v^{1/2} (H - h_v) [B + z(H - h_v)]$

(USE  $C' = 0.95$ )

WHERE  $h_v = \frac{3(2zH + B) - (16z^2H^2 + 16zBH + 9B^2)^{1/2}}{10z}$

$C' =$  ENTRANCE COEFFICIENT

CHECK LIST  
HYDROLOGIC AND HYDRAULIC  
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 17.6 square miles(farmland & woodland)  
ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 635.4 (2753 Ac-ft)  
ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 657.1 (11,600 Ac-ft)  
ELEVATION MAXIMUM DESIGN POOL: 656.0  
ELEVATION TOP DAM: 657.1

SPILLWAY CREST:

a. Elevation 643.6  
b. Type Broad crested weir  
c. Width 30'  
d. Length 170'  
e. Location Spillover Right abutment  
f. Number and Type of Gates None

OUTLET WORKS:

a. Type 48" conduit with concrete intake tower - uncontrolled  
b. Location In lake near upstream slope  
c. Entrance inverts 634.9  
d. Exit inverts 602.5  
e. Emergency draindown facilities 36" sluice gate and conduit

HYDROMETEOROLOGICAL GAUGES:

a. Type None  
b. Location \_\_\_\_\_  
c. Records \_\_\_\_\_

MAXIMUM NON-DAMAGING DISCHARGE: Unknown

\*\*\*\*\*

FLOOD HYDROGRAPH PACKAGE (HEC-1)

DAM SAFETY VERSION JULY 1978

LAST MODIFICATION 11 JAN 79

\*\*\*\*\*

1	A1	ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF									
2	A2	HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF MIDDLE CREEK DAM									
3	A3	RATIOS OF PMF ROUTED THROUGH THE RESERVOIR PA. TO NO 55-45									
4	B	288	0	15	0	0	0	0	0	-4	0
5	B1	5									
6	J	1	6	1							
7	J1	0.2	0.3	0.4	0.5	0.75	1				
8	K	0	1				1				
9	K1	INFLOW TO RESERVOIR									
10	M	1	1	17.6		17.6					1
11	P	1	22.8	111	121	130	137	140	1.0	0.02	
12	T										
13	M	5.57	0.50								
14	X	-1.5	-0.05	2.0							
15	K	1	2						1		
16	K1	ROUTE THRU RESERVOIR									
17	Y				1	1					
18	Y1	1									
19	Y4	634.9	635.4	636.4	637.5	637.9	643.6	644.6	645.6	646.6	647.6
20	Y4	648.6	649.6	651.6	653.6	655.6	657.6	659.6	661.6	666.6	671.6
21	Y5	0	26	136	292	324	350	359	1800	3034	4520
22	Y5	6230	8149	12577	17750	22637	30220	37490	45440	68270	95421
23	SA	0	239	270	312	360	400	440	500	595	680
24	SP	600.34	634.59	637	640	643	645	647	650	655	660
25	SS	643.6									
26	SD	657.6	3.05	1.5	1360						
27	F	99									

\*\*\*\*\*  
 FLOOD HYDROGRAPH PACKAGE (HFC-1)  
 DAM SAFETY VERSION JULY 1978  
 LAST MODIFICATION 11 JAN 79  
 \*\*\*\*\*

RUN DATE 79/03/19.  
 TIME 14.06.25.

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF  
 HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF MIDDLE CHEEK DAM  
 RATIOS OF PMF ROUTED THROUGH THE RESERVOIR PA. ID NO 55-45

NO	NHR	NMIN	IDAY	JOB SPECIFICATION				METRC	IPLT	IPRT	NSTAN
				JOPER	NWT	LROPT	TRACE				
288	0	15	0	0	0	0	0	0	0	-4	0
			5	0	0	0	0				

MULTI-PLAN ANALYSES TO BE PERFORMED

RTIOS= .20 .30 .40 .50 .75 1.00  
 NPLAN= 1 NRTIO= 6 LRTIO= 1

SUB-AREA RUNOFF COMPUTATION

INFLOW TO RESERVOIR

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRI	INAME	ISTAGE	IAUTU
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA



\*\*\*\*\*

# HYDROGRAPH ROUTING

## ROUTE THRU RESERVOIR

	ISTAQ	ICOMP	TECON	ITAPE	JPLI	JPRI	INAME	ISTAGE	IAUTU
	2	1	0	0	0	0	1	0	0
	ROUTING DATA								
QLOSS	CLOSS	AVG	IRIS	ISAME	IOPT	IPMP		LSIR	
0.0	0.000	0.00	1	1	0	0		0	
	NSIPS	NSIDL	LAG	AMSKK	X	ISK	STORA	ISPRAT	
	1	0	0	0.000	0.000	0.000	-635.	-1	
STAGE	634.90	635.40	637.50	637.90	643.60	644.60	645.60	646.60	
647.60									
648.60		651.60	653.60	655.60	657.60	659.60	661.60	666.60	
671.60									
FLOW	0.00	136.00	292.00	324.00	350.00	859.00	1800.00	3034.00	
4520.00									
6230.00	8149.00	12577.00	17750.00	23637.00	30220.00	37490.00	45440.00	68290.00	
95421.00									
SURFACE AREA	0.	239.	270.	312.	400.	440.	500.	595.	680.
CAPACITY	0.	2753.	3287.	4160.	5167.	5926.	6766.	8175.	10909.
ELEVATION	600.	635.	637.	640.	643.	645.	647.	650.	655.
									660.

CREE SPWID CDDW EXPW ELEV CDD CAREE EAPL

643.6 0.0 0.0 0.0 0.0 0.0 0.0 0.0

DAM DATA			
TOPEL	COQD	EXPD	DAMWID
657.6	3.1	1.5	1360.

PEAK OUTFLOW IS 964. AT TIME 57.00 HOURS

PEAK OUTFLOW IS 2682. AT TIME 52.50 HOURS

PEAK OUTFLOW IS 4451. AT TIME 50.75 HOURS

PEAK OUTFLOW IS 6271. AT TIME 49.75 HOURS

PEAK OUTFLOW IS 10918. AT TIME 48.50 HOURS

PEAK OUTFLOW IS 15540. AT TIME 48.00 HOURS

\*\*\*\*\* \*\*\*\*\* \*\*\*\*\* \*\*\*\*\*

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS  
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)  
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO	RATIOS APPLIED TO FLOWS					
					1	2	3	4	5	6
					.20	.30	.40	.50	.75	1.00
HYDROGRAPH AT	1	17.60	1	4043.	6065.	8086.	10108.	15162.	20215.	
	(	45.58)	(	114.49)	171.73)	228.97)	286.22)	427.33)	572.44)	
ROUTED TO	2	17.60	1	964.	2682.	4451.	6271.	10918.	15540.	
	(	45.58)	(	27.29)	75.96)	126.05)	177.59)	309.17)	440.08)	

# SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

ELEVATION	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
STORAGE	634.90	643.60	657.60
OUTFLOW	2753.	5386.	12512.
	0.	350.	30220.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF	
						MAX OUTFLOW HOURS	FAILURE HOURS
.20	644.71	0.00	5812.	964.	0.00	57.00	0.00
.30	646.32	0.00	6470.	2682.	0.00	52.50	0.00
.40	647.55	0.00	7013.	4451.	0.00	50.75	0.00
.50	648.62	0.00	7505.	6271.	0.00	49.75	0.00
.75	650.85	0.00	8607.	10918.	0.00	48.50	0.00
1.00	652.75	0.00	9618.	15940.	0.00	48.00	0.00



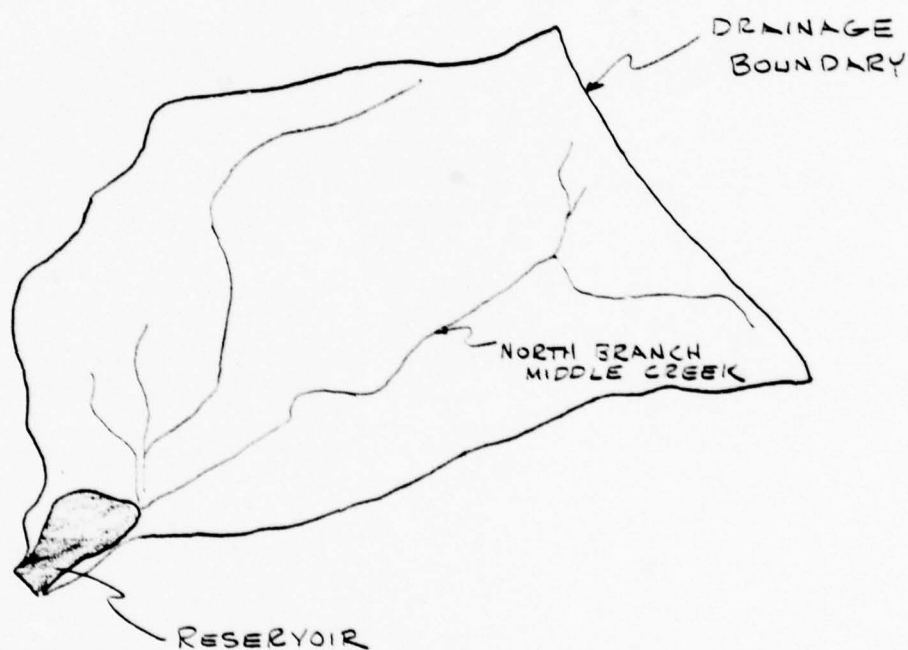
L. ROBERT KIMBALL & ASSOCIATES  
CONSULTING ENGINEERS & ARCHITECTS  
EBENSBURG PENNSYLVANIA

DAM NAME MIDDLE CREEK DAM  
I.D. NUMBER 2. 55-45

SHEET NO. 1 OF 1  
BY OTM DATE 4-12-79

SHAPE OF DRAINAGE AREA

(FROM D.E.R. FILE)



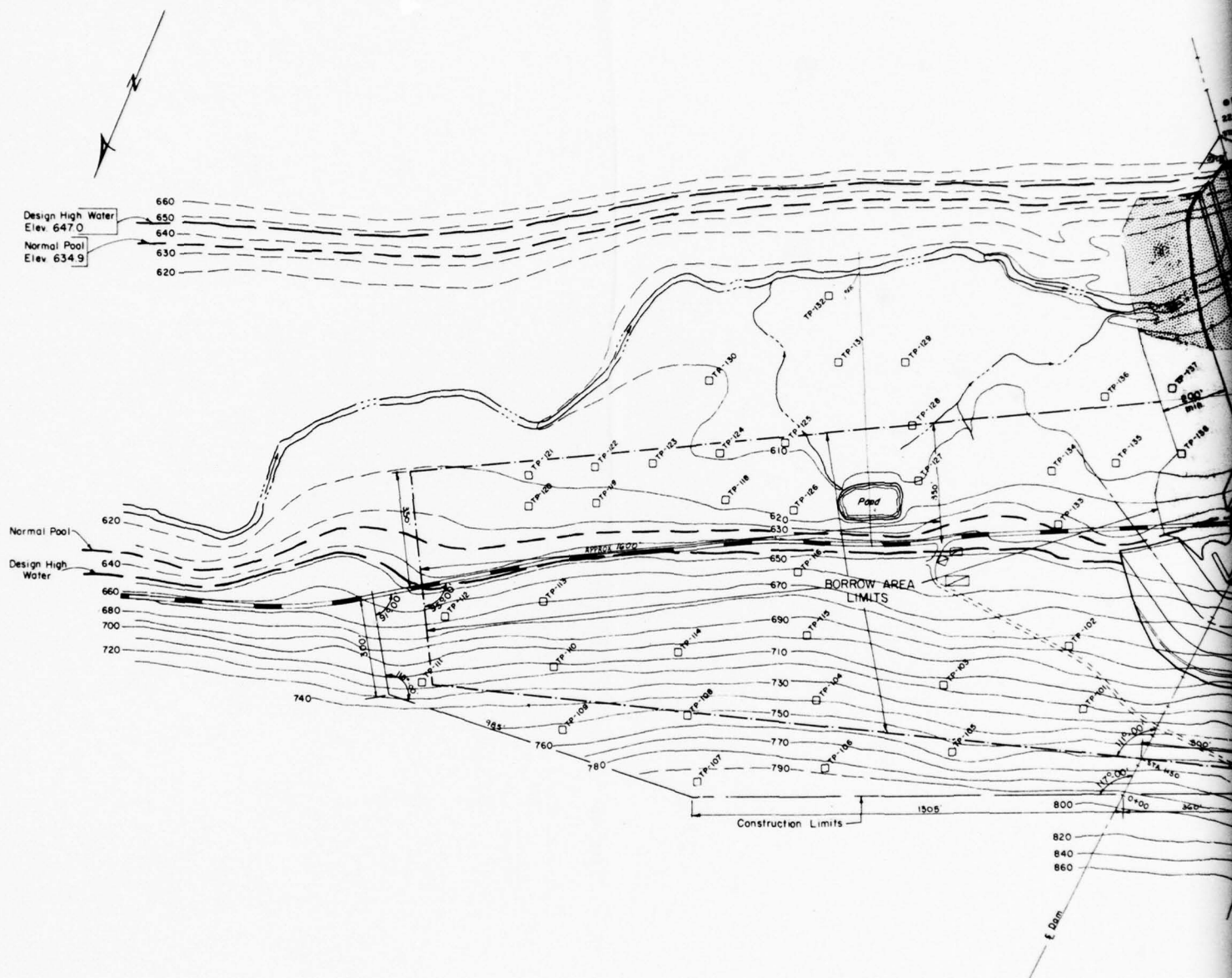
SCALE: 1" = 1.5 MILES

APPENDIX E

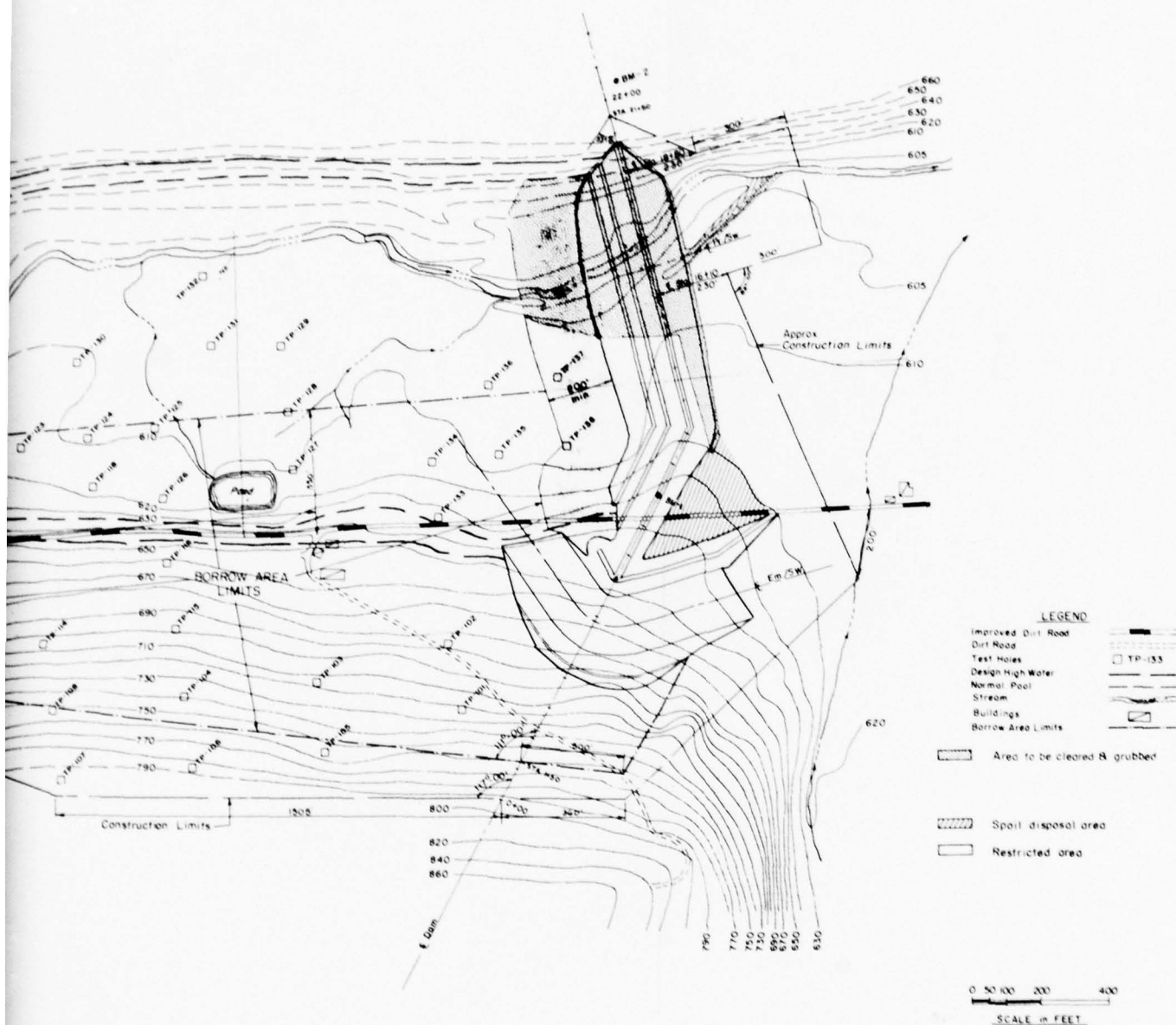
DRAWINGS



FIGURE 1



1. For log
2. No bar  
upstream
3. No pay  
grubbi  
area



#### NOTES

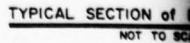
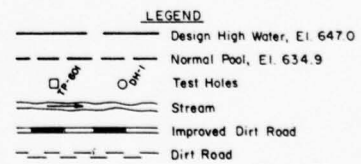
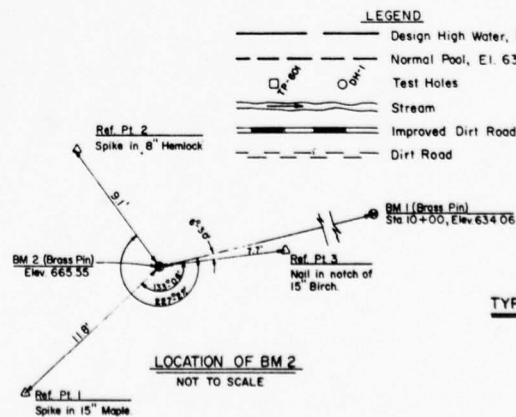
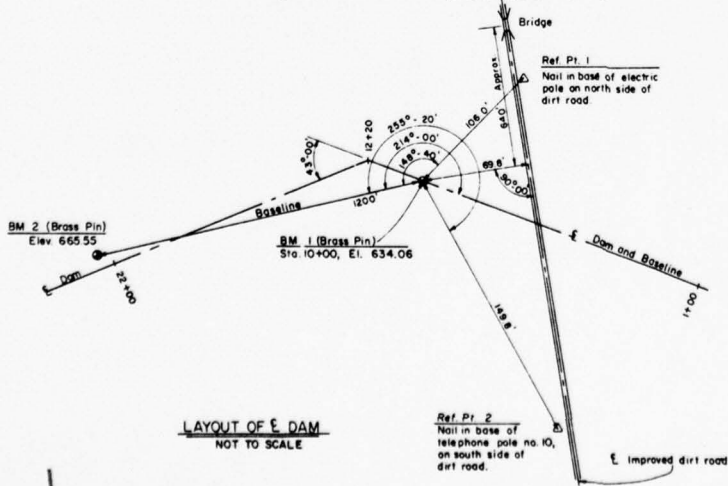
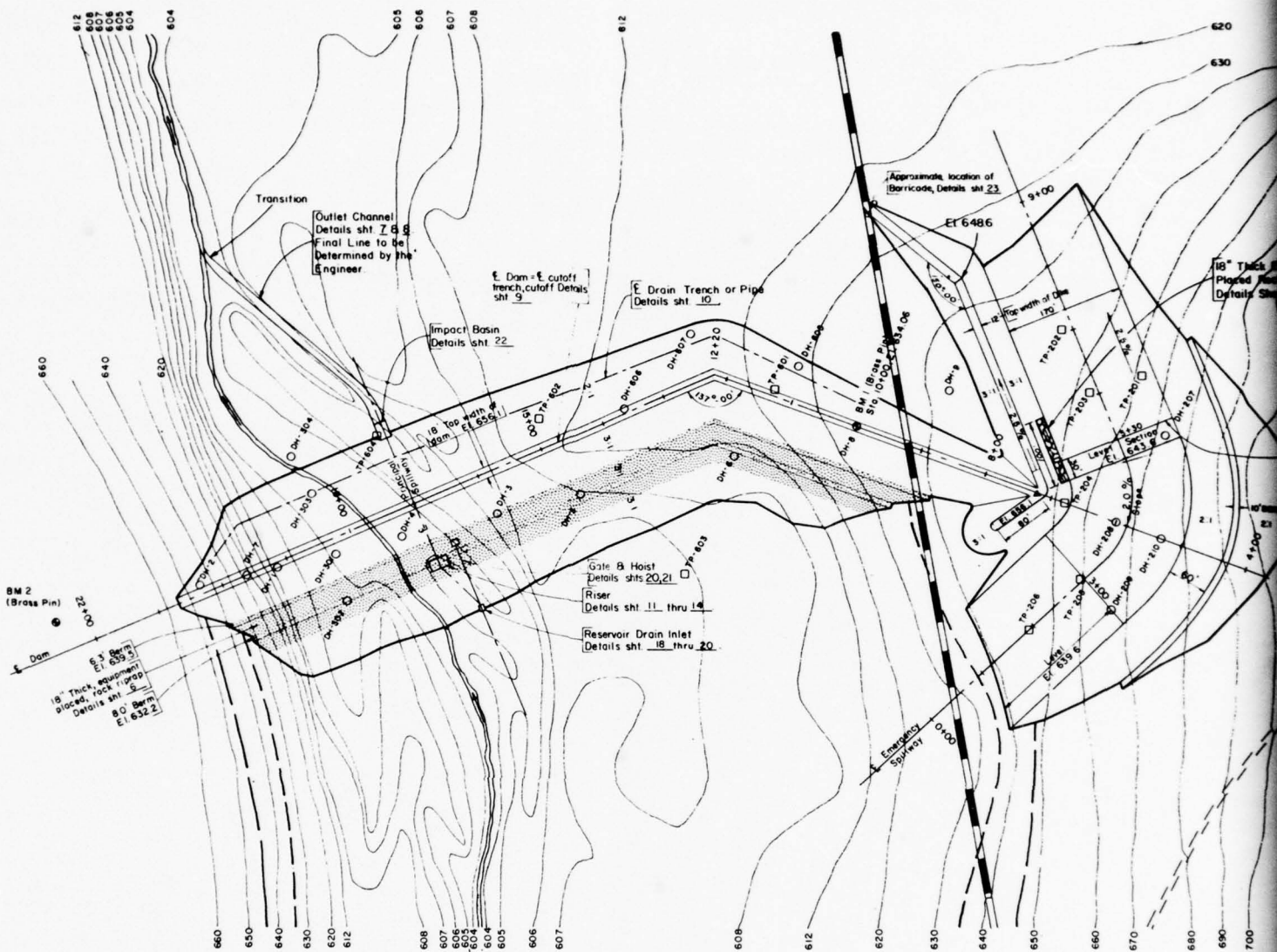
1. For logs of test holes see sheets 25 thru 28.
2. No borrow shall be obtained within 200' of the upstream toe.
3. No payment shall be made for any clearing & grubbing that may be required in the borrow area or em/aw area.

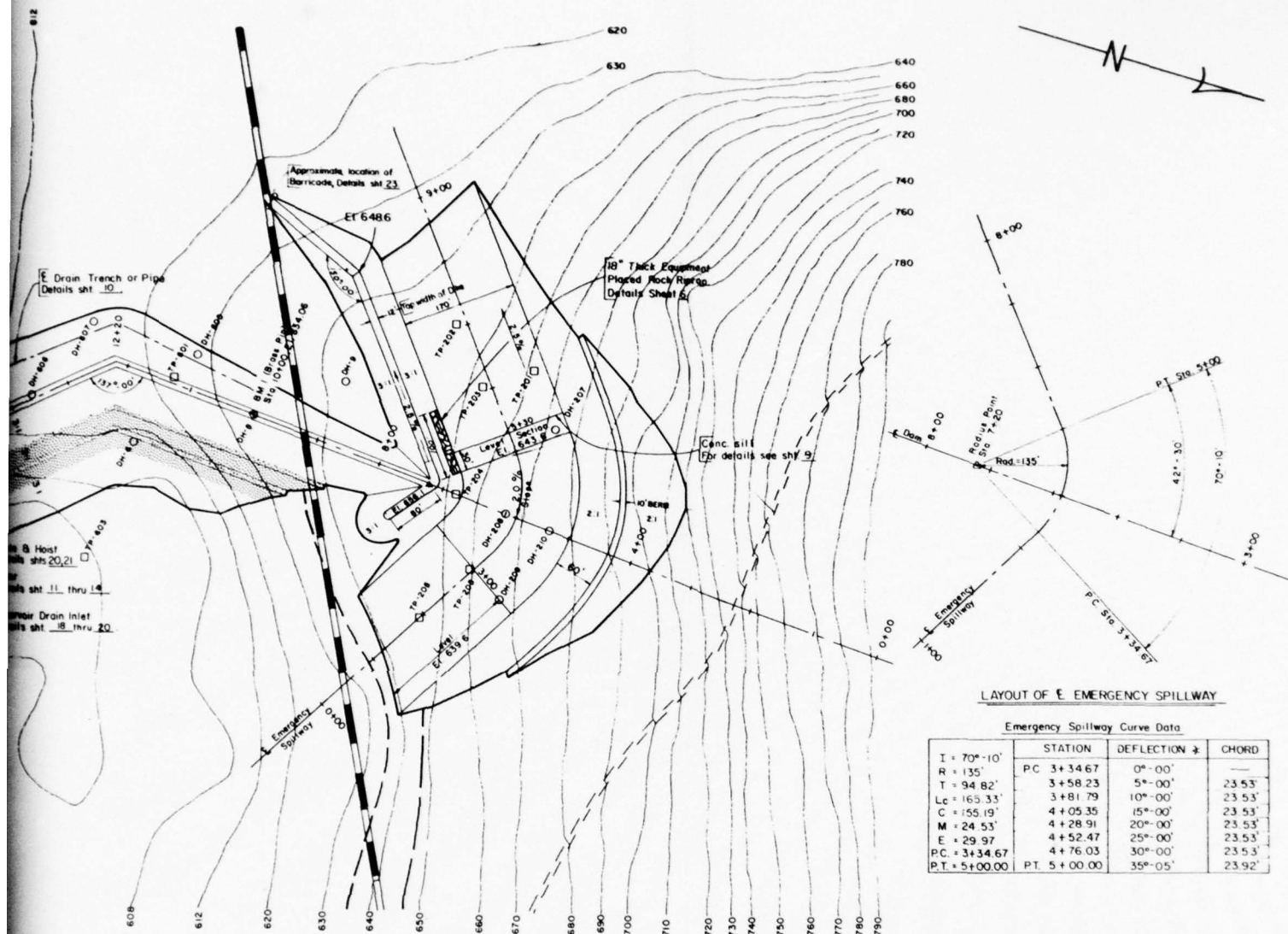
MIDDLE CREEK WATERSHED			
MULTIPLE PURPOSE DAM PA-637			
SNYDER COUNTY, PENNSYLVANIA			
PLAN OF BORROW AREA			
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
Designed <i>Ronald E. Hubby</i>	Date <i>3-67</i>	Approved By	
Drawn <i>C. Criss</i>	3-67	Title	
Traced		Sheet	
Checked <i>Edgar C. Snyder</i>	6-67	Drawing No.	PA-637-P

ASS: (

SCS-315B (APRIL 1960)

**L. ROBERT KIMBALL & ASSOCIATES**  
CONSULTING ENGINEERS & ARCHITECTS  
FIGURE 2





LAYOUT OF E. EMERGENCY SPILLWAY

Emergency Spillway Curve Data

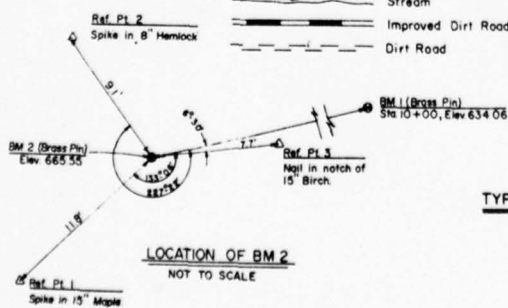
	STATION	DEFLECTION $\Delta$	CHORD
$I = 70^\circ - 10'$			
$R = 135'$	PC 3+34.67	$0^\circ - 00'$	
$T = 94.82'$	3+58.23	$5^\circ - 00'$	23.53'
$Lc = 165.33'$	3+81.79	$10^\circ - 00'$	23.53'
$C = 155.19'$	4+05.35	$15^\circ - 00'$	23.53'
$M = 24.53'$	4+28.91	$20^\circ - 00'$	23.53'
$E = 29.97'$	4+52.47	$25^\circ - 00'$	23.53'
PC + 3+34.67	4+76.03	$30^\circ - 00'$	23.53'
PT + 5+00.00	PT 5+00.00	$35^\circ - 05'$	23.92'

LEGEND

- Design High Water, El. 647.0
- Normal Pool, El. 634.9
- Test Holes
- Stream
- Improved Dirt Road
- Dirt Road

CONSTRUCTION NOTES

1. For logs of test holes see sheet 25 thru 28.



TYPICAL SECTION OF EM/SW BERM  
NOT TO SCALE

0 20 50 100 200  
SCALE in FEET

MIDDLE CREEK WATERSHED  
MULTIPLE PURPOSE DAM PA-637  
SNYDER COUNTY, PENNSYLVANIA  
PLAN OF STRUCTURAL WORKS

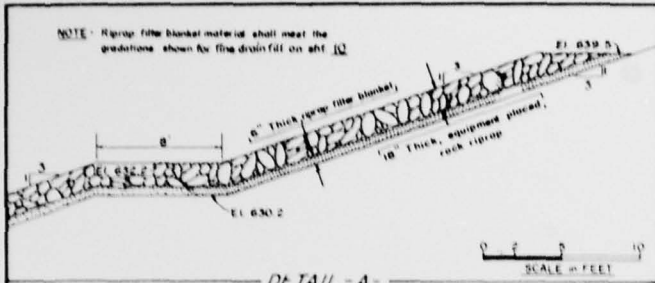
U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

Designed <i>Donald R. Hahley</i>	Date 3-67	Approved by
Drawn C. CRISE	3-67	Title
Traced		Sheet
Checked <i>Alfred A. Snyder</i>	6-67	No. 5
		29
		Drawing No. PA-637-P

L. ROBERT KIMBALL & ASSOCIATES  
CONSULTING ENGINEERS & ARCHITECTS

FIGURE 31

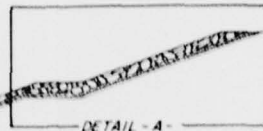
NOTE: Riprap filter blanket material shall meet the gradations shown for fine drainfill on sheet 10.



DETAIL - A

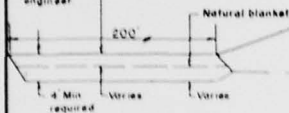
Rock riprap Whirpool filter blanket

El. 620.0



DETAIL - A

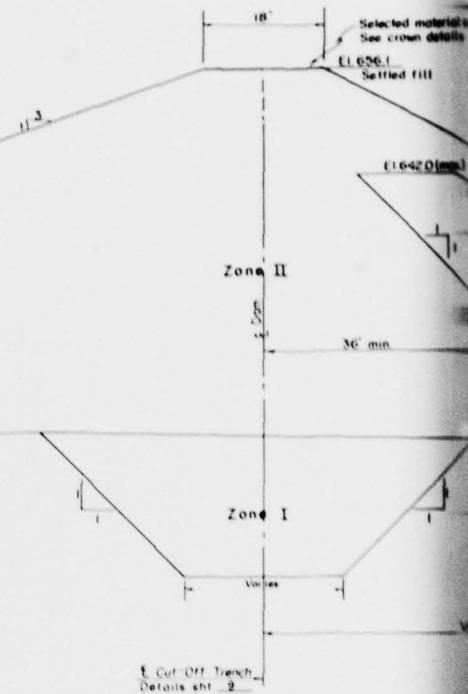
Zone II fill, required thickness and lateral limits as determined by the engineer.



Approx. Foundation Excavation Line



TYPICAL CROWN DETAILS  
For embankment and dike



TYPICAL SECTION OF EMBANKMENT

SCALE in FEET

#### EARTH FILL REQUIREMENTS

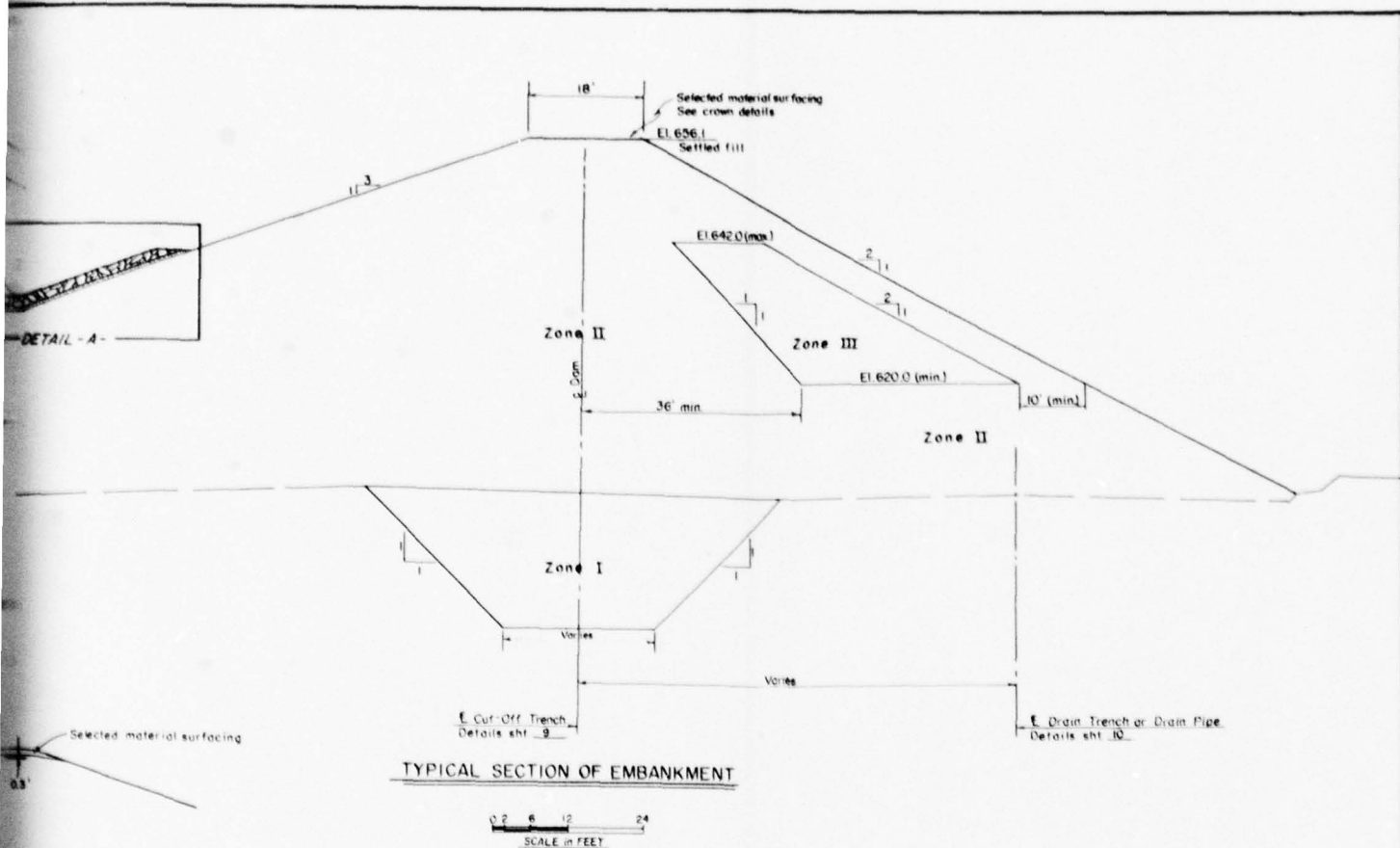
ZONE	MATERIAL	MAX ROCK SIZE	MAX LIFT THICKNESS	REQUIRED WATER CONTENT	CLASS	COMPACTION DEFINITION
I	Material as represented by TP-152, depth 1 to 15' classified as CL	6"	9"	Optimum to +3%	A	100% max density by ASTM D698 method A
II	Material as represented by TP-202, depth 1 to 6' classified as CL, or by TP-251, depth 1 to 6' classified as GC-OM	6"	9"	Optimum to +3%	A	95% max density by ASTM D698 method A
III	Siltstone and/or shale	6"	12"	See subsection 10.11 of special requirements		

1. For fill adjacent to structures, max rock size 5"
2. Maximum permissible lift thickness before compaction
3. Water content of fill matrix at time of compaction
4. For typical compaction curves see sheet 29



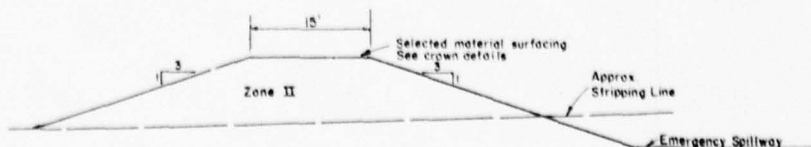
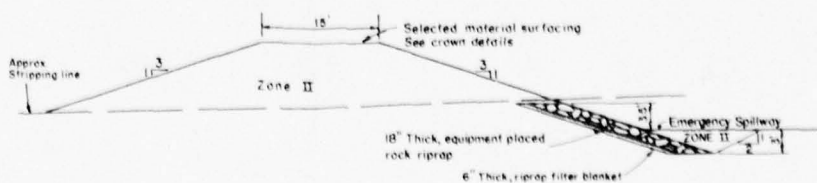
TYPICAL SECTION OF DIKE ALONG EM/SW

SCALE in FEET



OWN DETAILS  
I and dike

ACTION	DEFINITION
1. max density	100% DSS
2. max density	100% DSS
3. max density	100% DSS
4. max density	100% DSS
5. max density	100% DSS
6. max density	100% DSS
7. max density	100% DSS
8. max density	100% DSS
9. max density	100% DSS
10. max density	100% DSS



MIDDLE CREEK WATERSHED MULTIPLE PURPOSE DAM PA-637 SNYDER COUNTY, PENNSYLVANIA FILL PLACEMENT	
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
Designed by <i>Donald R. Kimball</i> 4-67	Approved by _____
Drawn by <i>C. CRIBE</i> 4-67	Checked by _____
Traced by _____	Scale _____
Checked by <i>Donald R. Kimball</i> 6-67	Sheet No. 6 Drawing No. PA-637-P

L. ROBERT KIMBALL & ASSOCIATES  
CONSULTING ENGINEERS & ARCHITECTS

FIGURE 4

A horizontal scale bar with markings at 0, 5, 10, 20, and 40 feet, labeled "HORIZ." below it. To its right is a vertical scale bar with markings at 0, 2, 5, 10, and 20 feet, labeled "VERT." below it. Centered between the two bars is the text "SCALE in FEET".

FIGURE 5



RESERVOIR DRAIN INLET

CONCRETE BEDDING



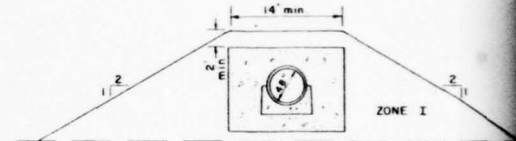
RESERVOIR DRAIN ANTI-SEEP COLLAR

RISER

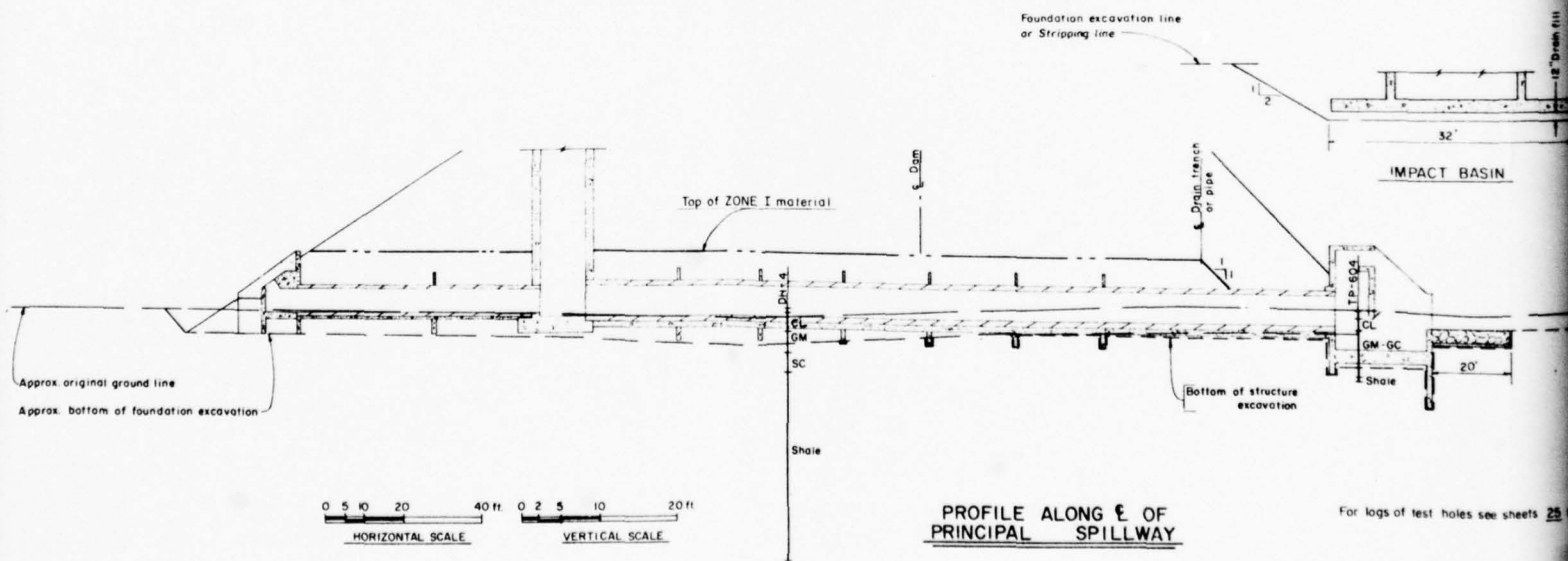


CRADLE

CRADLE

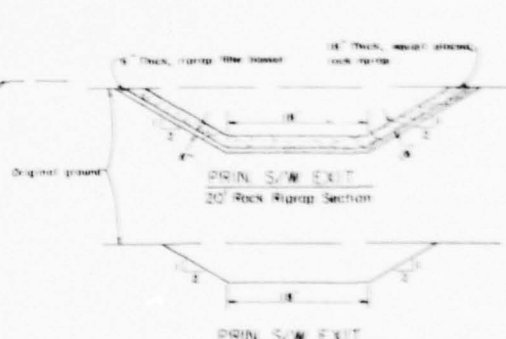
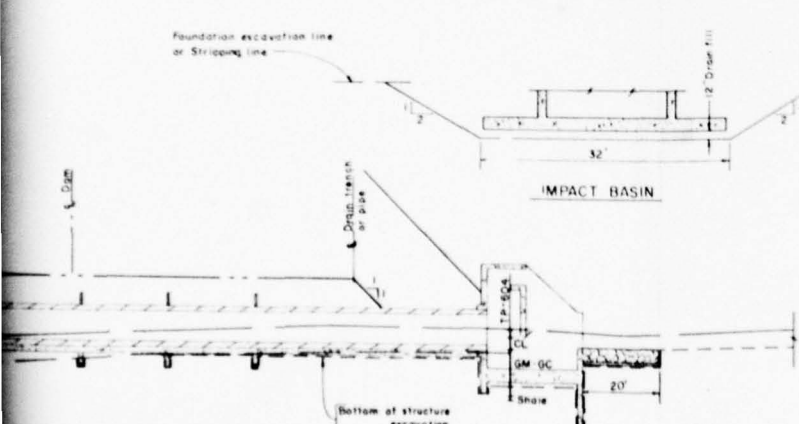
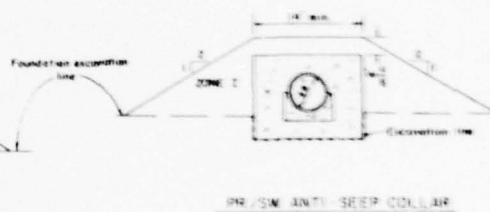
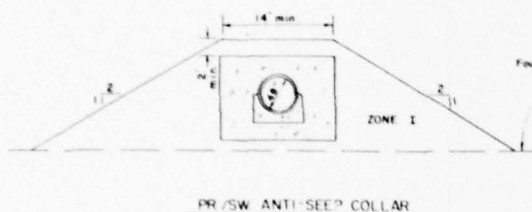
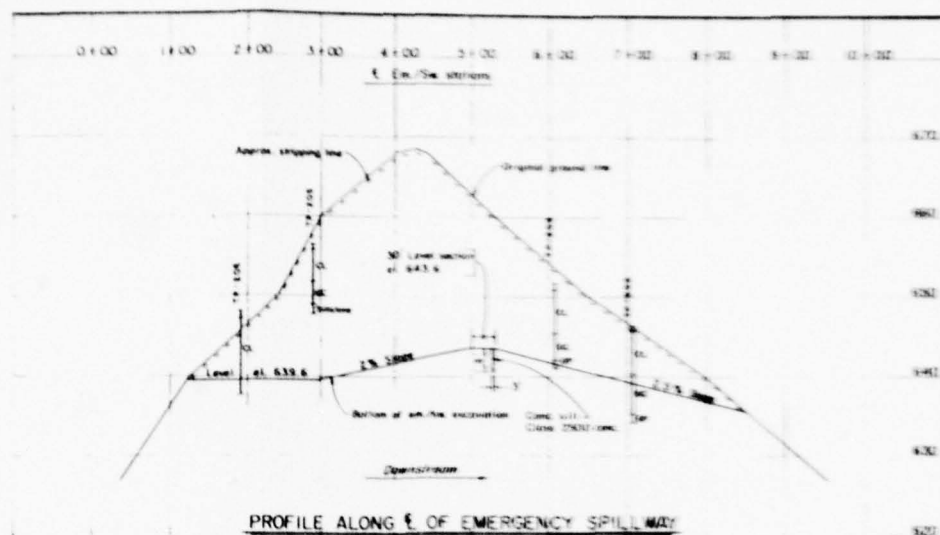


PR/SW ANTI-SEEP COLLAR



PROFILE ALONG E OF PRINCIPAL SPILLWAY

For logs of test holes see sheets 25



PROFILE ALONG E OF PRINCIPAL SPILLWAY

For logs of test holes see sheets 25 thru 28

MIDDLE CREEK WATERSHED	
MULTIPLE PURPOSE DAM PA-637	
SNYDER COUNTY, PENNSYLVANIA	
SPILLWAY EXCAVATION	
U. S. DEPARTMENT OF AGRICULTURE	
SOIL CONSERVATION SERVICE	
Designed: <i>Robert Kimball</i>	Drawn: <i>C. CRIDE</i>
Checked: <i>Paul J. Smith</i>	PA-637-P

L. ROBERT KIMBALL & ASSOCIATES  
CONSULTING ENGINEERS & ARCHITECTS

FIGURE 6

21+00

19+00

17+00

15+00

13+00

11+00

9+00

7+20

f Dam Stations

680

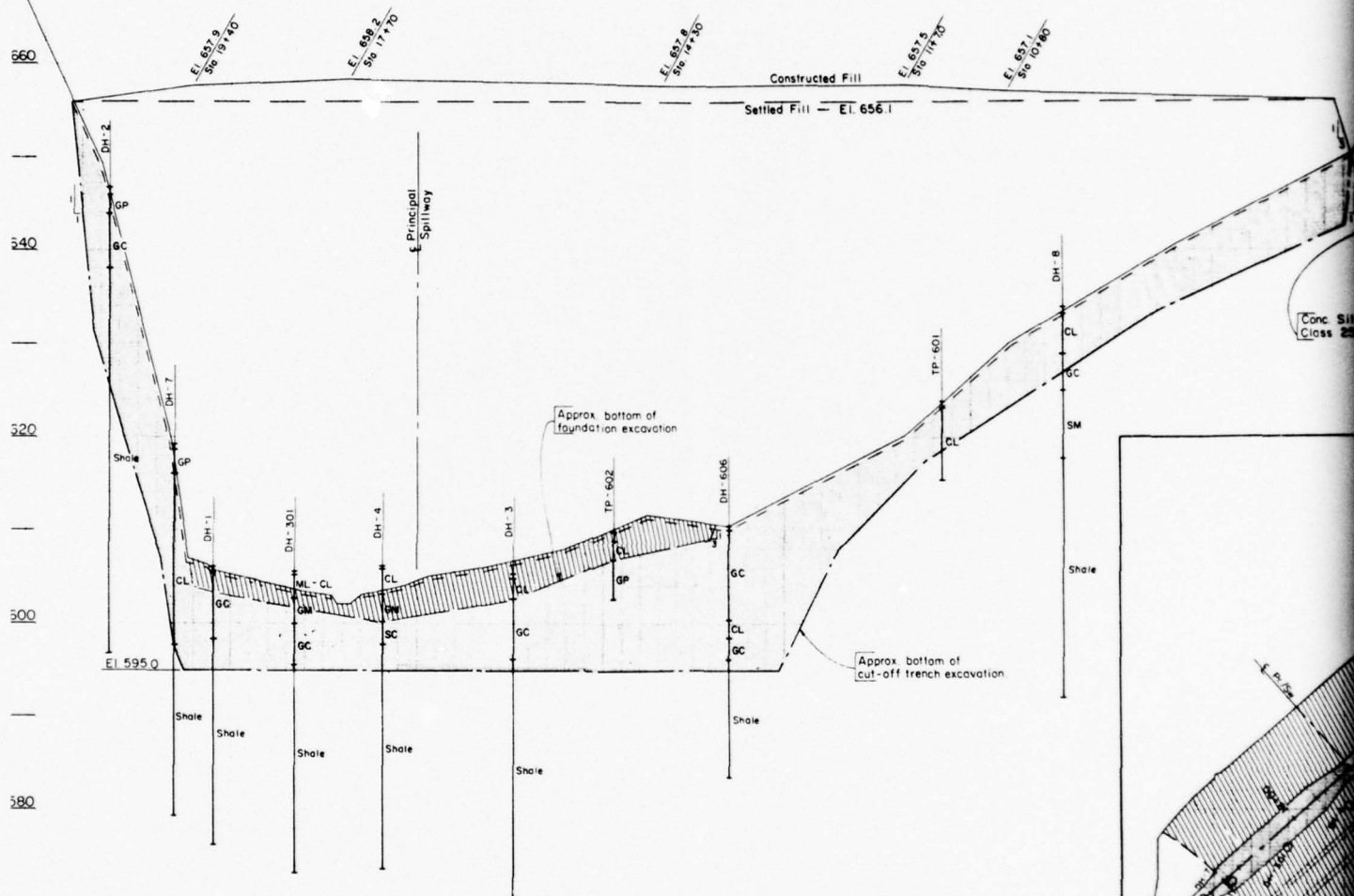
660

640

620

600

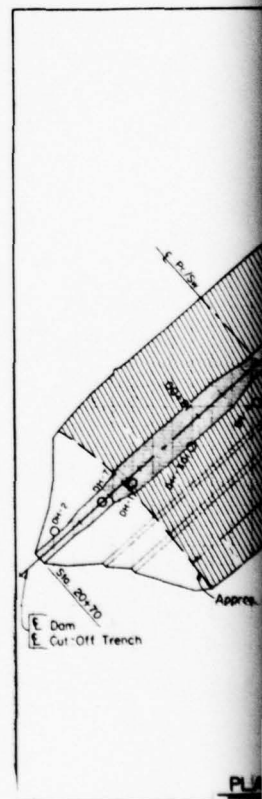
580

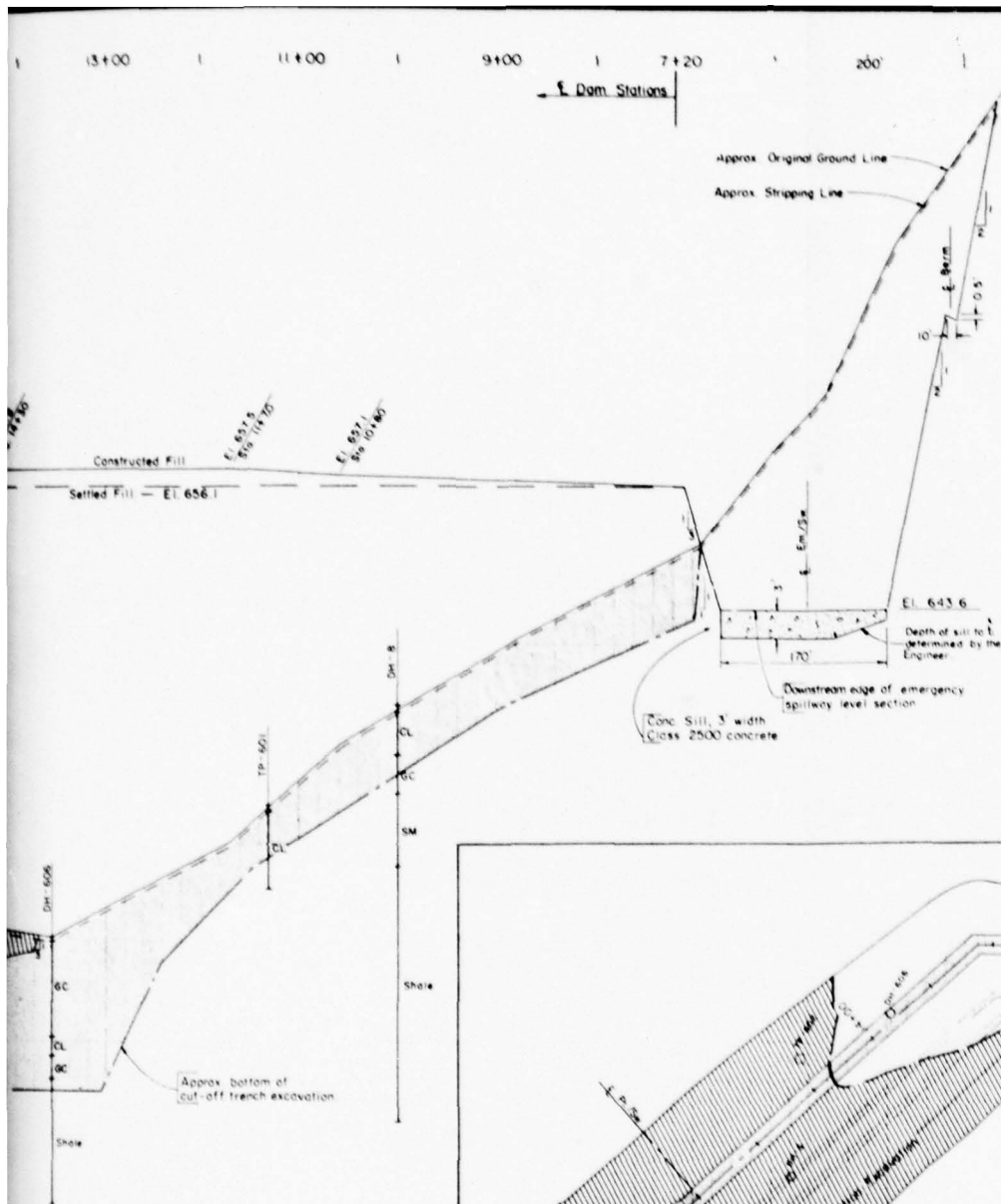


# PROFILE ALONG f OF CUT-OFF TRENCH AND UPSTREAM EDGE OF LEVEL SECTION

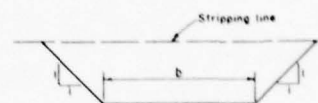
## CONSTRUCTION OF

1. For logs of test holes see sheets 23, thru
2. Foundation excavation shall consist of the soft, we

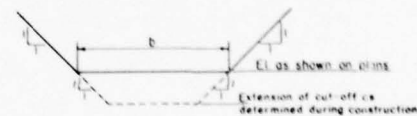




STATION	BOTTOM WIDTH (b)
6+85 to 9+70	12'
9+70 to 9+90	Transition (12' to 24')
9+90 to 17+20	24'
17+20 to 17+60	Transition (24' to 40')
17+60 to 19+20	40'
19+20 to 19+50	Transition (40' to 24')
19+50 to 19+93	24'
19+93 to 20+13	Transition (24' to 12')
20+13 to 20+70	12'



Typical from sta 6+85 to 13+00,  
and sta 19+50 to 20+70

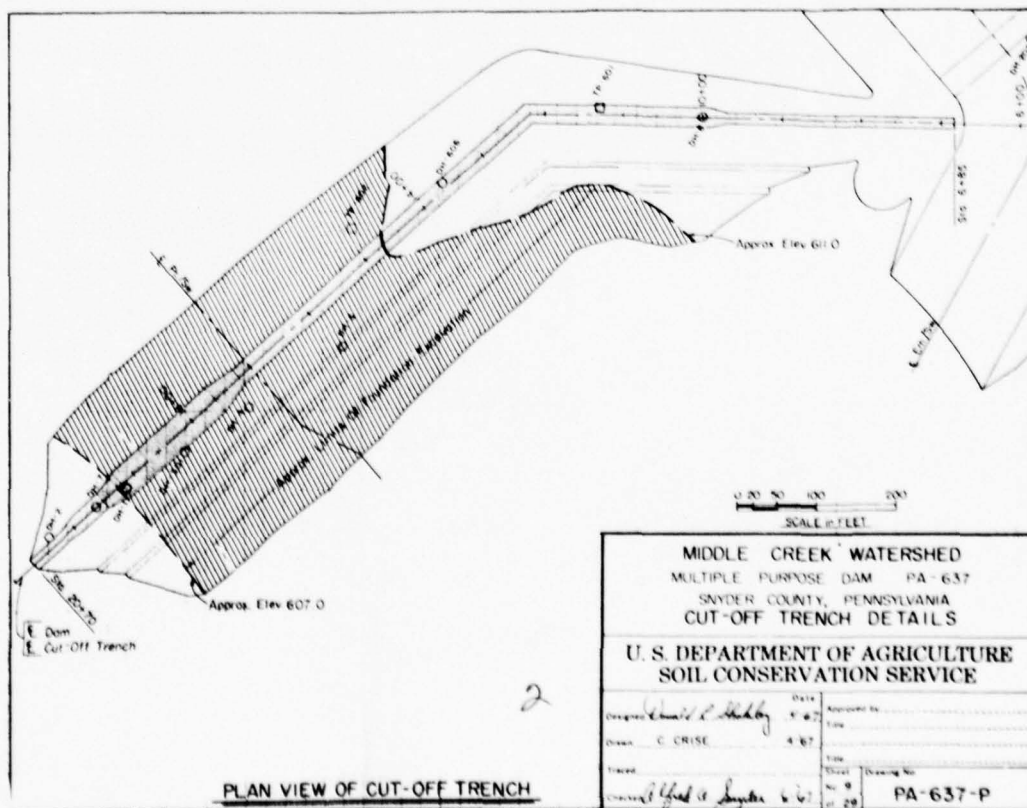


Typical from sta 13+00 to 19+50

#### SECTIONS THRU CUT-OFF TRENCH

#### OF CUT-OFF TRENCH AND GE OF LEVEL SECTION

CONSTRUCTION OF  
p 600 sheets 23, thru  
Wall consist of the soft, we:

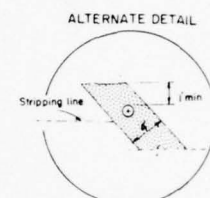
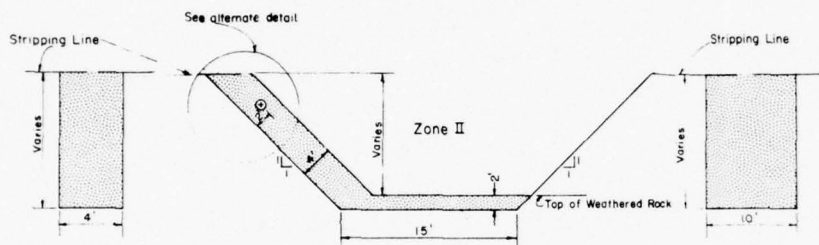
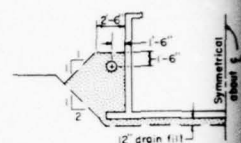
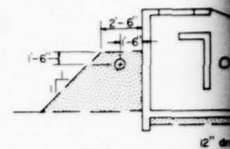
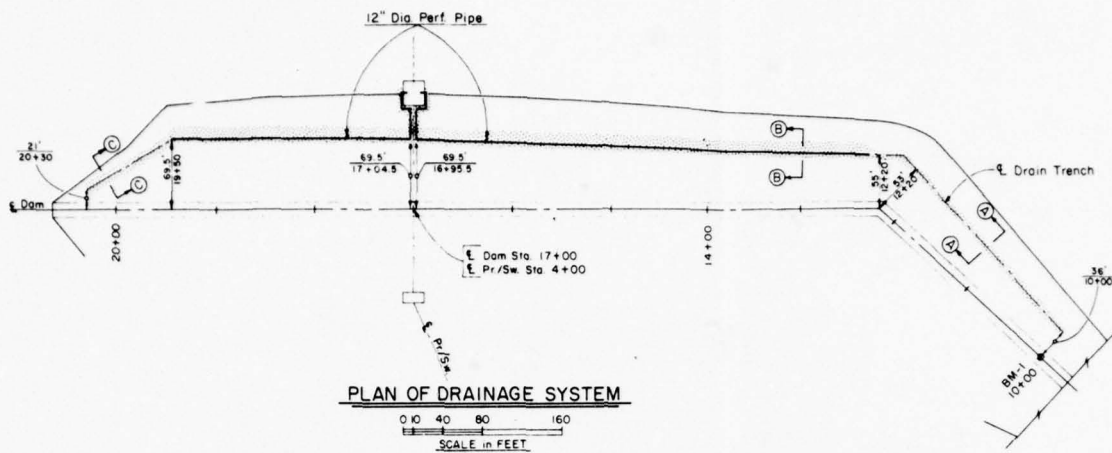


#### PLAN VIEW OF CUT-OFF TRENCH

0 50 100 200  
SCALE IN FEET

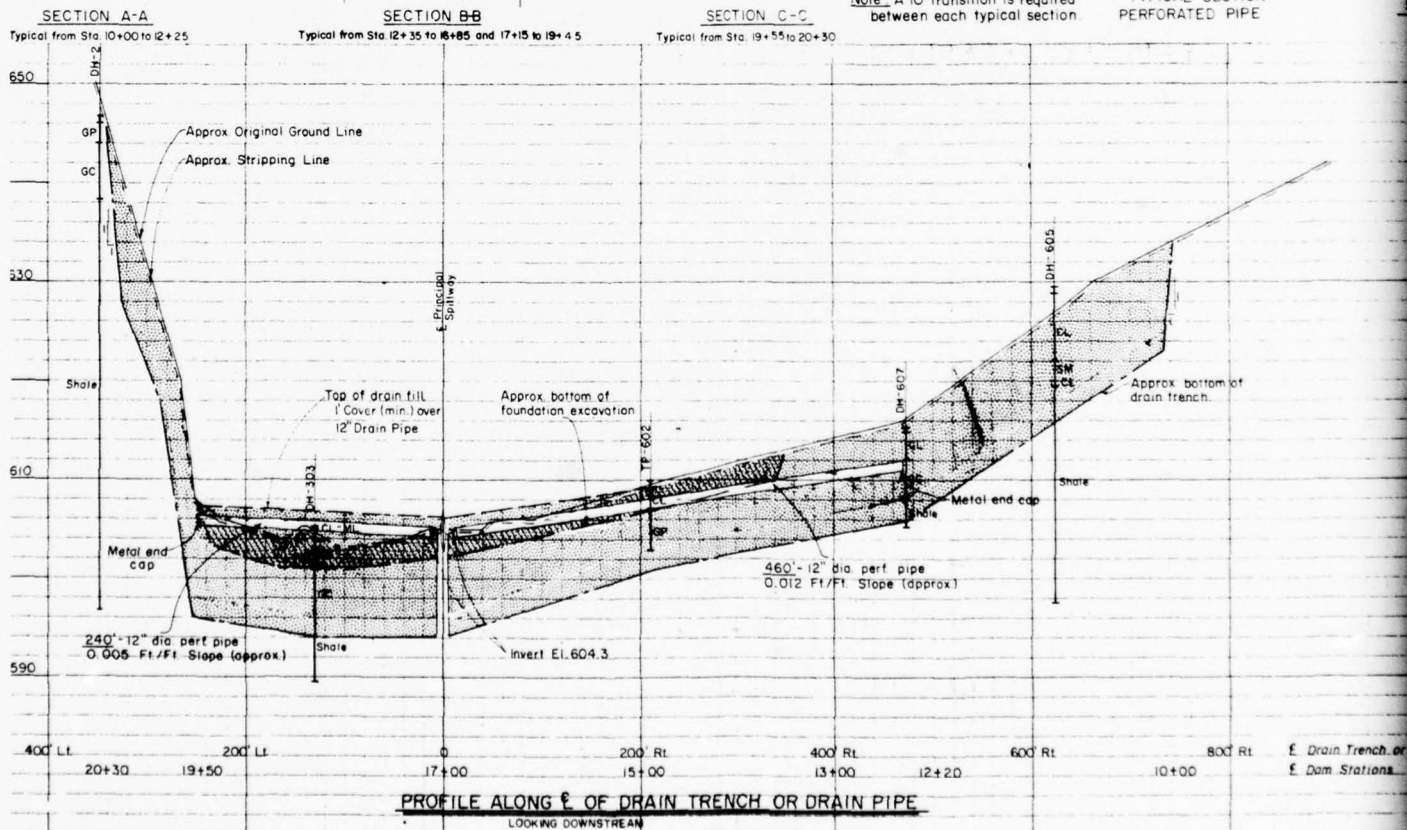
MIDDLE CREEK WATERSHED MULTIPLE PURPOSE DAM PA-637 SNYDER COUNTY, PENNSYLVANIA CUT-OFF TRENCH DETAILS			
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
Designed by C. CRUSE	Date 4-67	Approved by [Signature]	Time
Drawn by C. CRUSE	Date 4-67	Checked by [Signature]	Time
Drawing No. PA-637-P		FORM SCS-316 (APRIL 1963)	

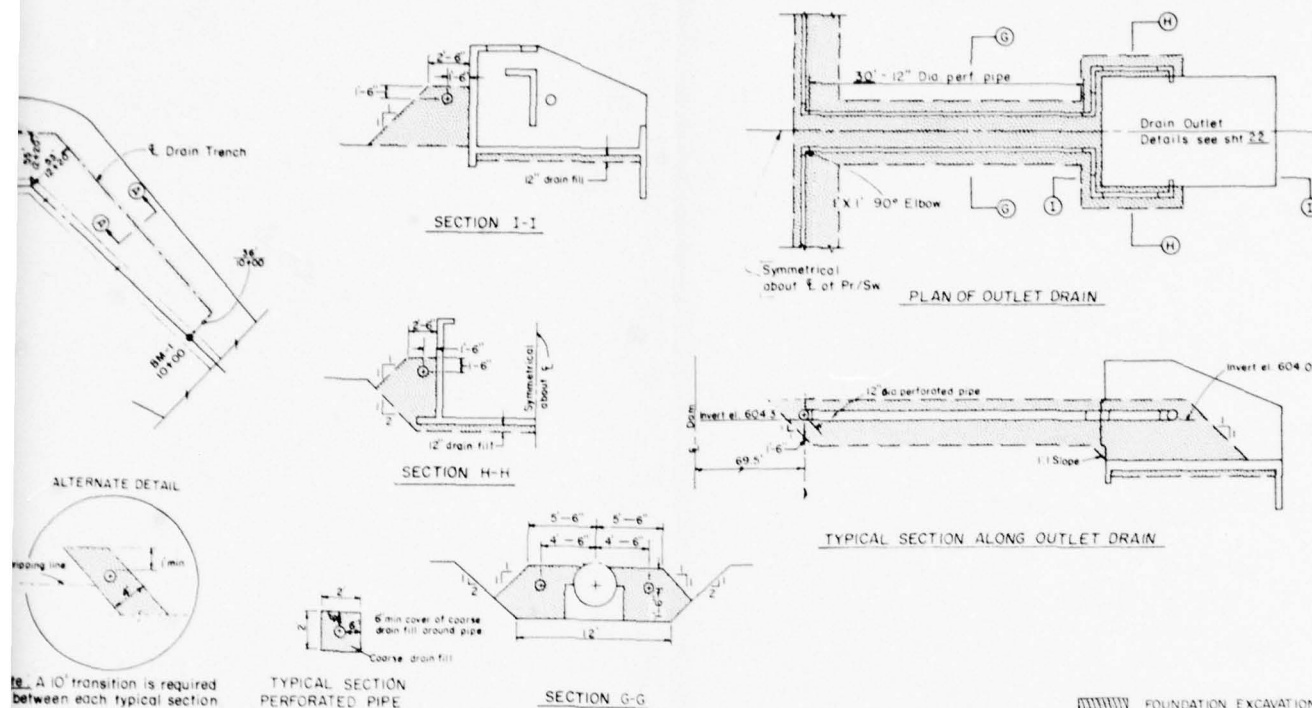
A55-1



Note: A 10' transition is required between each typical section

TYPICAL SECTION PERFORATED PIPE





FOUNDATION EXCAVATION  
DRAIN FILL

#### CONSTRUCTION NOTES

- All drain pipe shall conform to material specification 110, and shall be 12" dia., 16 gauge, shape I, class I, type D, perforated pipe.
- Bottom of the drain trench to be 2' in weathered rock for the entire length.
- For logs of test holes, see sheets 25, 26, 27, 28.
- Riprap filter blanket material shall meet fine drain fill gradation limits.

#### QUANTITY SUMMARY

12" Dia. Perforated Pipe  
37 - 20' Sections  
4 - 10' Sections  
2 - 1' x 1' Elbows-90°  
2 - 3'-5" x 4'-4" Elbows-90°  
2 - 3'-4" x 2'-0" Elbows-90°  
2 - 3'-0" x 1'-8" Elbows-90°  
2 - Metal End Caps  
2 - Small Animal Guards (Details in 15)  
8' x 6' Total (Use standard coupling bands)

#### GRADATION LIMITS FINE DRAIN FILL

Sieve No.	% Passing
No. 2	100
No. 4	90 - 100
No. 8	75 - 92
No. 16	50 - 80
No. 30	30 - 65
No. 50	10 - 50
No. 100	5 - 15

#### GRADATION LIMITS COARSE DRAIN FILL

Sieve No.	% Passing
No. 2	100
No. 4	90 - 100
No. 8	20 - 55
No. 16	0 - 10
No. 30	0 - 5

Note: Percentage based on dry weight.

MIDDLE CREEK WATERSHED  
MULTIPLE PURPOSE DAM PA-637  
SNYDER COUNTY, PENNSYLVANIA  
DRAINAGE DETAILS

U.S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

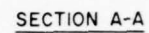
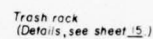
Designed by <i>R. J. Mays</i>	Date 3-67
Drawn by <i>R. J. Mays</i>	Title 4-67
Checked by <i>R. J. Mays</i>	Sheet No. 10 of 29
	Drawing No. PA-637-P

A55:1

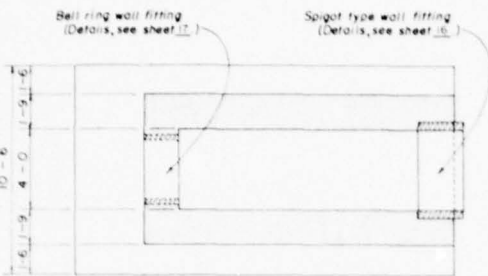
Form SCS-317 (November 1955)

L. ROBERT KIMBALL & ASSOCIATES  
CONSULTING ENGINEERS & ARCHITECTS

FIGURE 8

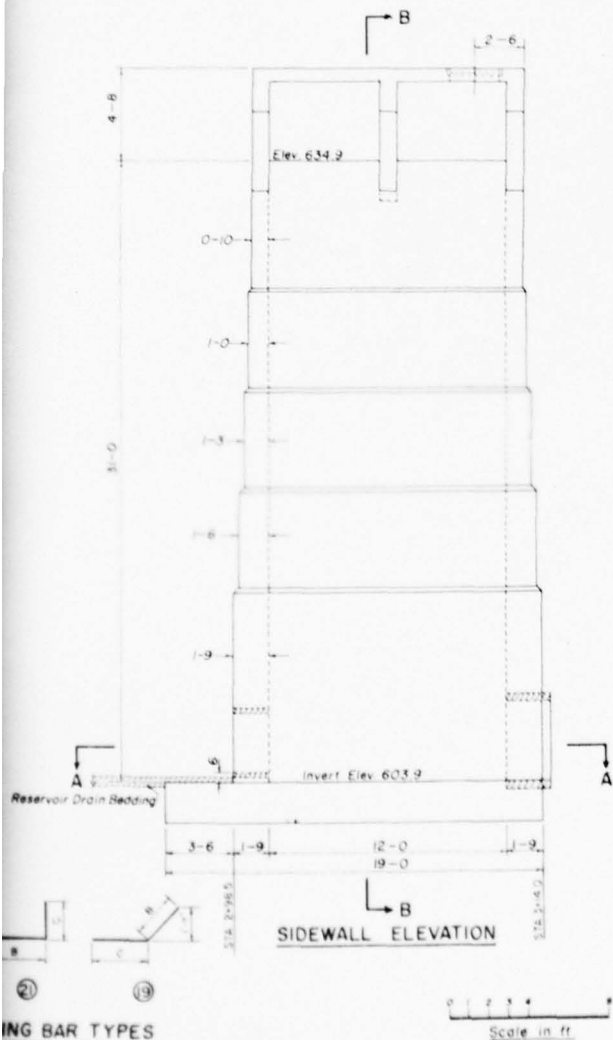


A horizontal scale bar with tick marks at intervals of 1 unit, labeled 0, 1, 2, 3, 4, and 6. Below the bar is the text "Scale in ft."



SECTION A-A

Construction Details  
see sheet 15



ING BAR TYPES

Scale in ft.

STEEL SCHEDULE																			
MARK	SIZE	QUANTITY	LENGTH	TYPE	B	C	TOTAL LENGTH			MARK	SIZE	QUANTITY	LENGTH	TYPE	B	C	TOTAL LENGTH		
B-1	6	27	10-2	1			274.50			M-12	5	8	4-3	1	4-3		34.00		
B-2	6	32	18-8	1			597.33			M-13	5	8	4-6	1	4-6		36.00		
B-3	9	62	15-7	21	10-7	5-0	966.16			M-14	5	8	4-10	1	4-10		38.00		
B-4	7	6	11-3	21	9-0	2-3	67.50			M-15	5	8	5-0	1	5-0		40.00		
B-5	7	2	4-6	21	2-3	2-3	9.00			M-16	5	8	5-4	1	5-4		42.66		
B-6	7	3	4-3	21	2-0	2-3	12.75			M-17	5	8	5-8	1	5-8		45.33		
B-7	7	2	4-3	21	3-1	1-2	8.50			M-18	5	4	5-8	1			22.67		
B-8	7	11	3-9	1			41.25			M-19	5	4	5-4	1			21.33		
B-9	7	28	14-0	21	7-6	7-4	415.33			M-20	5	4	5-0	1			20.00		
B-10	6	4	10-3	21	1-9	8-6	41.00			M-21	5	4	4-10	1			19.33		
B-11	6	4	9-9	21	1-3	8-6	39.00			M-22	5	4	4-6	1			18.00		
B-12	6	8	9-6	21	1-0	8-6	76.00			M-23	5	4	4-3	1			17.00		
B-13	6	2	11-0	21	2-6	8-6	22.00			M-24	5	4	4-0	1			16.00		
B-14	6	10	13-0	21	4-6	8-6	130.00			M-25	5	4	3-8	1			14.67		
B-15	6	4	10-9	21	2-3	8-6	43.00			M-26	5	4	3-4	1			13.33		
B-16	6	8	10-3	21	1-9	8-6	82.00			M-27	5	4	3-0	1			12.00		
B-17	6	20	12-9	1			255.00			M-28	5	4	2-9	1			11.00		
B-18	6	6	4-9	1			28.50			M-29	5	4	2-6	1			10.00		
B-19	7	2	2-9	21	0-6	2-3	5.50			M-30	5	4	2-2	1			8.67		
B-20	7	2	3-6	21	1-3	2-3	7.00			M-31	5	12	14-4	19	1-8	12-8	172.00		
B-21	7	3	3-9	21	2-7	1-2	11.25			M-32	6	40	11-2	21	7-7	3-7	446.67		
B-22	6	8	4-0	1			32.00			M-33	6	4	14-5	21	7-7	6-10	57.67		
R-1	7	50	4-6	1			225.00			M-34	6	4	15-10	21	7-7	8-3	63.33		
R-2	7	36	7-3	1			261.00			M-35	5	2	17-0	1			34.00		
R-3	7	46	5-0	1			230.00			M-36	5	2	22-8	1			45.33		
R-4	6	46	4-6	1			207.00			M-37	5	4	28-4	1			113.33		
R-5	6	36	7-0	1			252.00			M-38	6	2	9-0	1			18.00		
R-6	6	40	4-4	1			173.33			M-39	6	2	11-4	1			22.67		
R-7	6	40	4-6	1			180.00			M-40	5	2	17-0	1			34.00		
R-8	6	36	7-0	1			252.00			M-41	5	2	22-8	1			45.33		
R-9	6	44	4-4	1			190.67			M-42	5	4	28-4	1			113.33		
R-10	5	44	4-6	1			198.00			M-43	5	2	5-8	1			11.33		
R-11	5	36	6-7	1			237.00			M-44	5	2	11-4	1			22.67		
R-12	5	36	3-10	1			138.00			M-45	5	2	17-0	1			34.00		
R-13	6	36	13-0	21	8-6	4-6	468.00			M-46	5	2	22-8	1			45.33		
R-14	6	40	12-6	21	8-3	4-3	500.00			M-47	5	4	28-4	1			113.33		
R-15	6	40	12-0	21	8-0	4-0	480.00			M-48	6	24	12-8	1			304.00		
R-16	6	40	11-6	21	7-9	3-9	460.00			M-49	6	20	4-8	1			93.33		
R-17	6	4	11-2	21	7-7	3-7	44.67			M-50	5	5	9-9	1			48.75		
R-18	6	80	4-9	1			380.00			M-51	5	52	12-9	1			663.00		
R-19	6	80	12-9	1			1020.00			M-52	4	11	28-4	1			311.67		
M-1	5	14	8-0	21	6-6		91.00			M-53	4	6	12-9	1			76.50		
M-2	5	58	5-9	1			333.50			M-54	5	3	9-9	1			29.25		
M-3	5	12	6-5	1			77.00			M-55	5	26	13-4	1			346.67		
M-4	5	14	6-4	21	6-4		88.66			M-56	4	11	28-4	1			311.67		
M-5	5	8	2-2	1	2-2		17.33			M-57	4	6	12-9	1			76.50		
M-6	5	8	2-6	1	2-6		20.00			M-58	5	26	5-9	1			149.50		
M-7	5	8	2-9	1	2-9		22.00			M-59	5	2	5-2	1			10.33		
M-8	5	8	3-0	1	3-0		24.00												
M-9	5	8	3-4	1	3-4		26.66												
M-10	5	8	3-8	1	3-8		29.33												
M-11	5	8	4-0	1	4-0		32.00												

QUANTITIES (Riser only)

CONCRETE Class 4000, 9023 Cu Yds

STEEL

No 4 Bars — 776.33 ft, 518.6 lbs  
No 5 Bars — 2806.61 ft, 3970.2 lbs  
No 6 Bars — 7233.67 ft, 10,865.0 lbs  
No 7 Bars — 1294.08 ft, 2215.1 lbs  
No 8 Bars — 966.16 ft, 3281.9 lbs  
Total — 21,283.8

Note: Concrete summary see shf 21

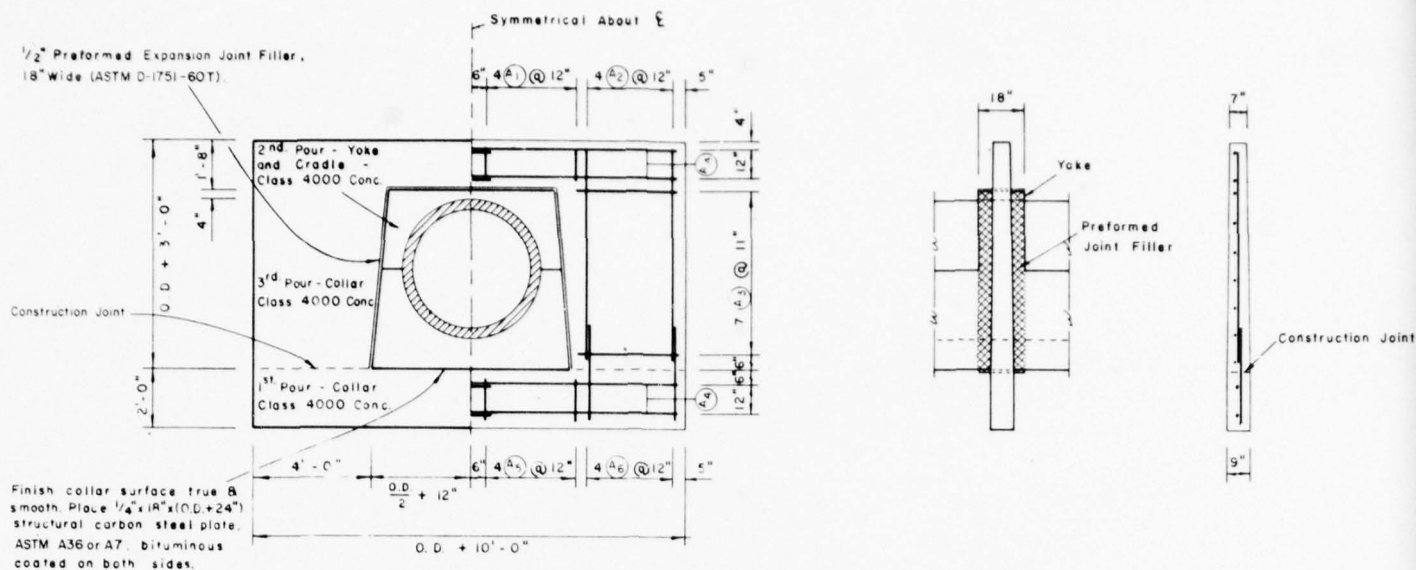
MIDDLE CREEK WATERSHED			
MULTIPLE PURPOSE DAM PA-637			
SNYDER COUNTY, PENNSYLVANIA			
RISER STRUCTURAL DETAILS			
U. S. DEPARTMENT OF AGRICULTURE			
SOIL CONSERVATION SERVICE			
Designed by	Geo. VanBuskirk	Date	Jan 67
Drawn by	R. J. WAYS	Date	4-67
Checked by		Date	
Project No.	PA-637-P	Sheet No.	22

ASS-1

SCS-313B (APRIL 1963)

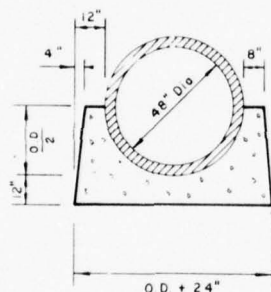
L. ROBERT KIMBALL & ASSOCIATES  
CONSULTING ENGINEERS & ARCHITECTS

FIGURE 9

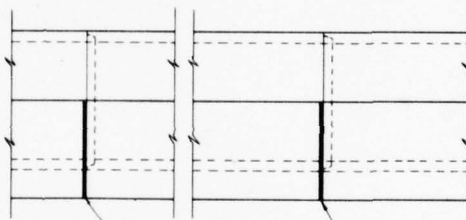


### REINFORCED CONCRETE ANTI-SEEP COLLAR

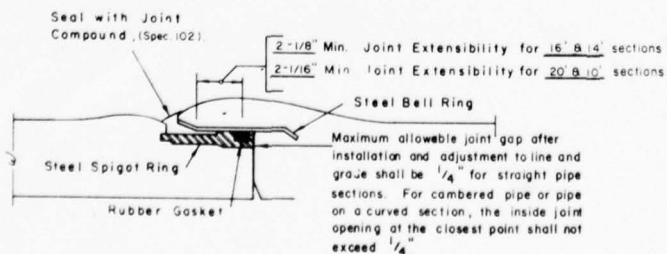
6 - Req'd



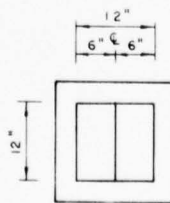
CONCRETE CRADLE  
(Class 4000 Conc.)



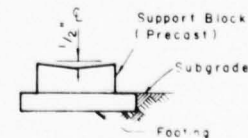
SIDE ELEVATION



REINFORCED CONCRETE WATER PIPE JOINT



PLAN



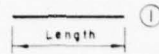
FRONT ELEV.

SUGGESTED SUPPORT BLOCK

NOTE:

The contractor shall determine the number and size of the blocks.

# BAR TYPE



## ANTI SEEP COLLAR STEEL SCHEDULE

Mark	Size	Length	Type	Quan. / Collar	Total Quan.	Total Length
A-1	4	1-3	1	8	48	60.00
A-2	4	7-3	1	8	48	348.00
A-3	4	3-6	1	14	84	294.00
A-4	4	8-0	1	8	48	384.00
A-5	4	1-6	1	8	48	72.00
A-6	4	3-9	1	8	48	180.00

### NOTE:

Bar lengths do not change with changes in outside diameter of pipe.

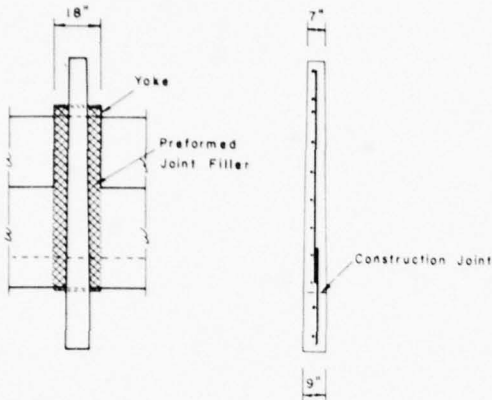
### QUANTITIES (This Sheet Only)

#### STEEL

No. 4 Bar 1338.00 \* 893.8 Lbs.

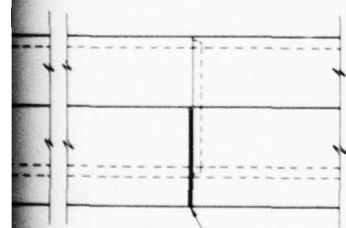
#### CONCRETE

Class 4000 108.86 Cu. Yds.

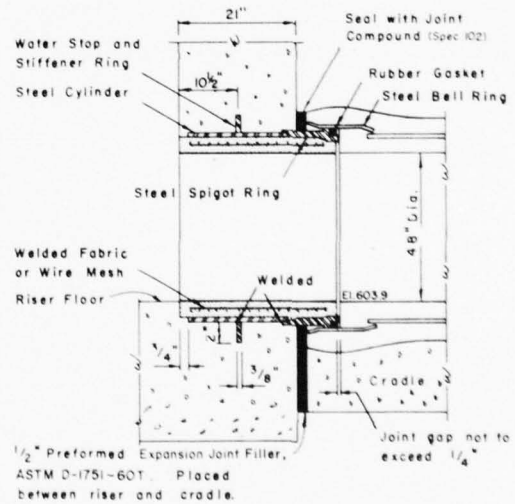


## ANTI-SEEP COLLAR

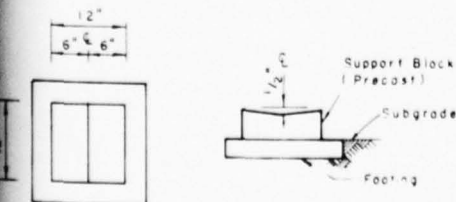
6 - Req'd



### SIDE ELEVATION



### SPIGOT RING WALL FITTING



PLAN FRONT ELEV.

### SUGGESTED SUPPORT BLOCK

#### NOTE:

The contractor shall determine the number and size of the blocks.

MIDDLE CREEK WATERSHED

MULTIPLE PURPOSE DAM PA-637

SNYDER COUNTY, PENNSYLVANIA

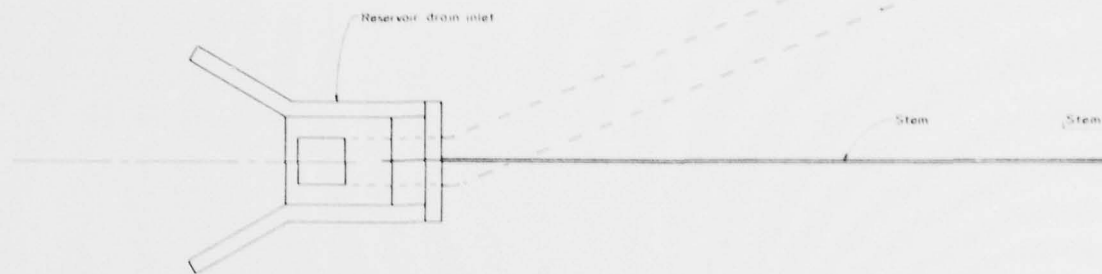
CONDUIT DETAILS

U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

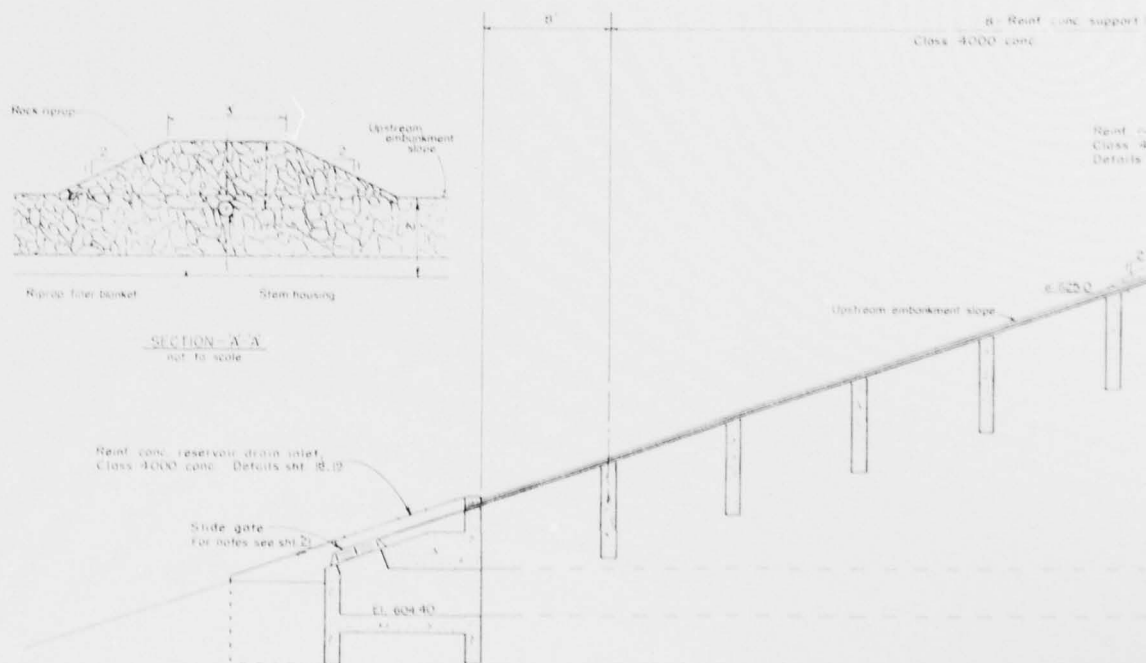
Designed by <i>Donald L. Kibler</i>	Date <i>3-67</i>	Approved by	
Drawn <i>C. Criss &amp; R. J. Mays</i>	Apr '67	Title	
Traced		Sheet	
Checked <i>Edward J. Ingber</i>	5-67	No. 16	PA-637-P
		of 29	

L. ROBERT KIMBALL & ASSOCIATES  
CONSULTING ENGINEERS & ARCHITECTS

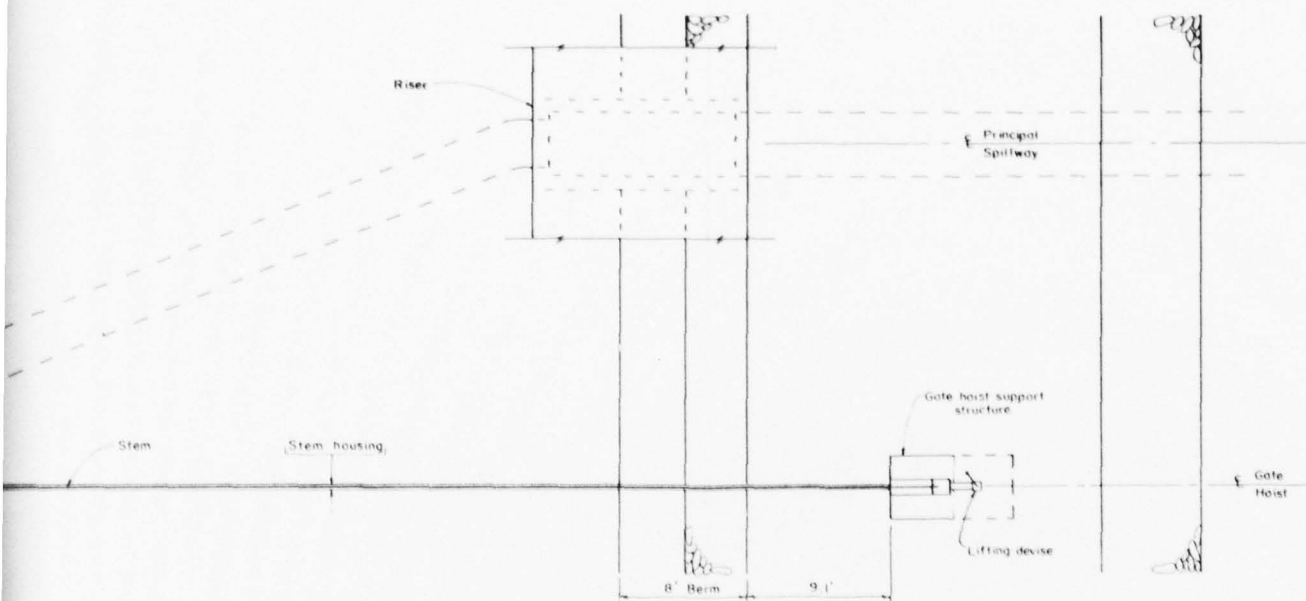
FIGURE 10



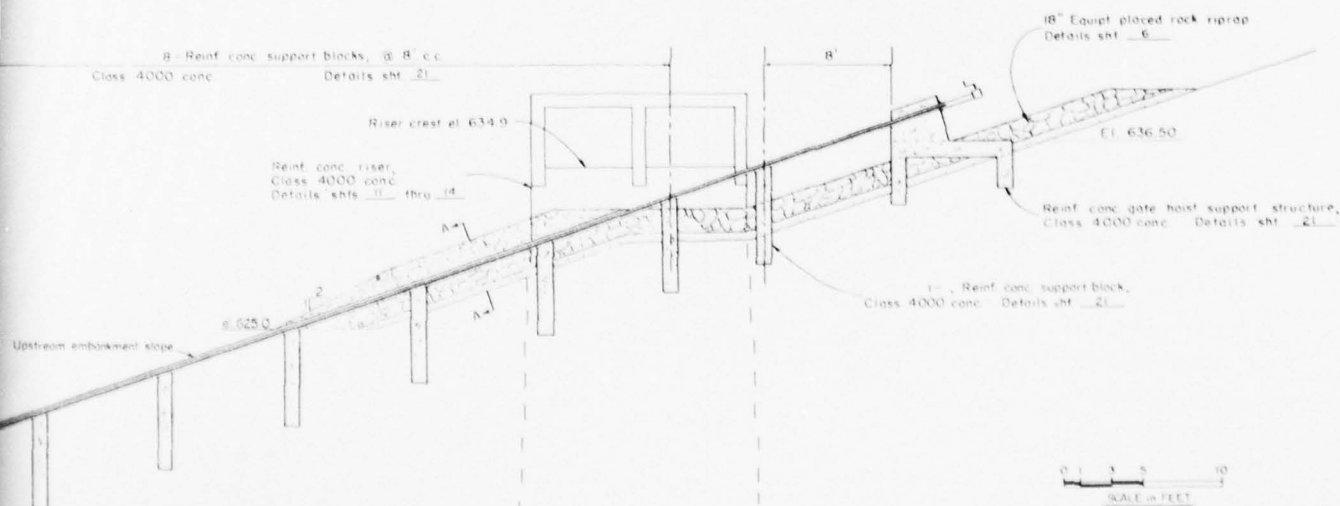
PLAN VIEW



PROFILE ALONG C OF GATE HO



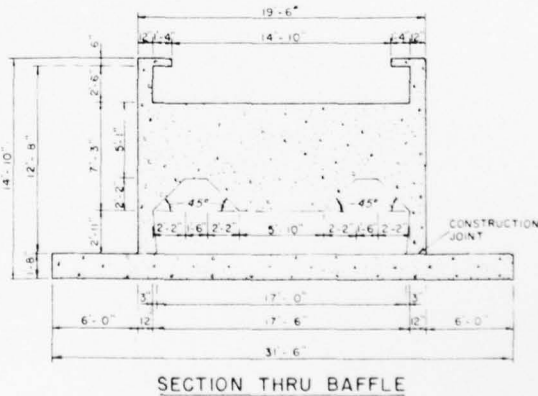
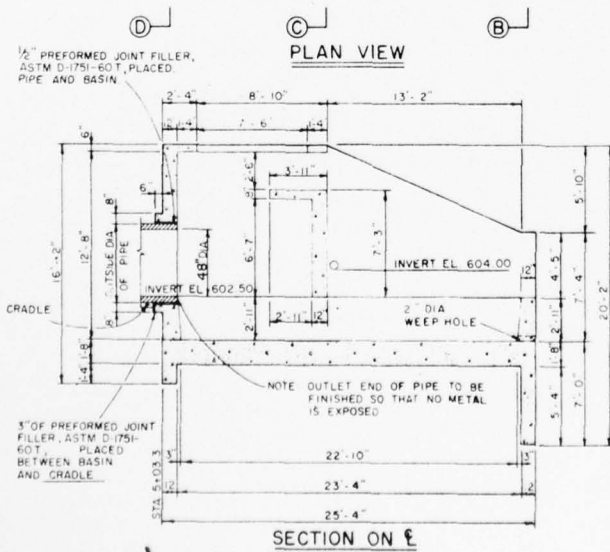
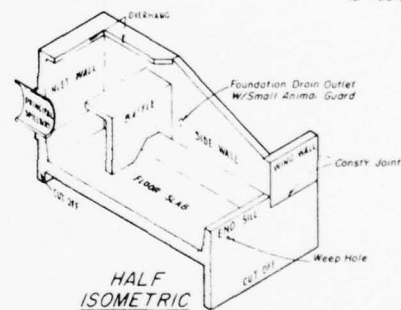
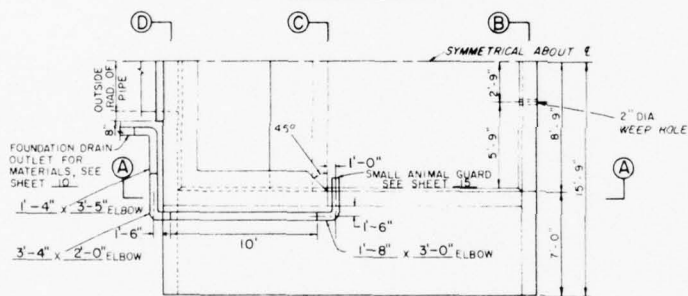
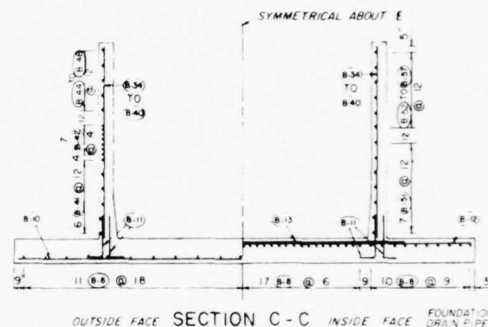
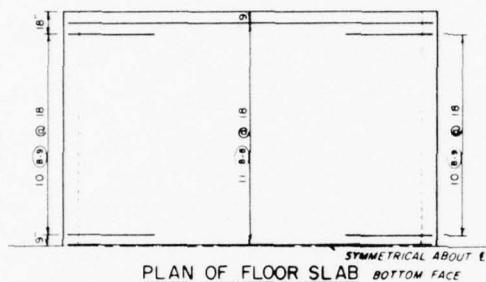
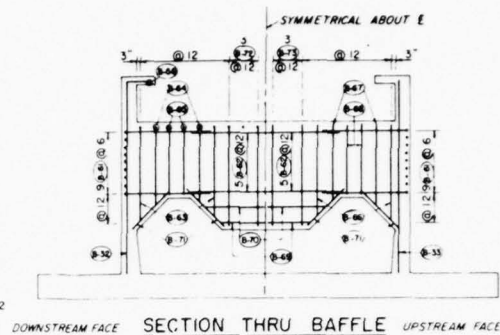
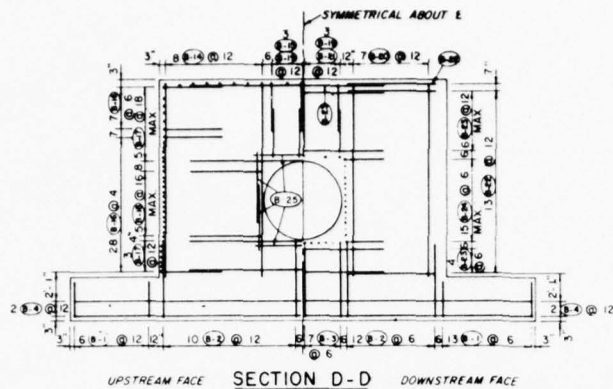
PLAN VIEW



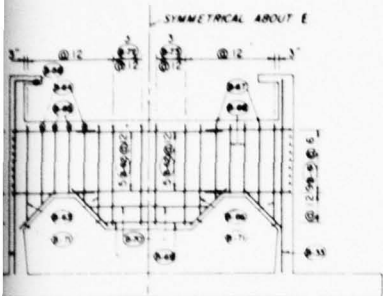
PROFILE ALONG E OF GATE HOIST

2

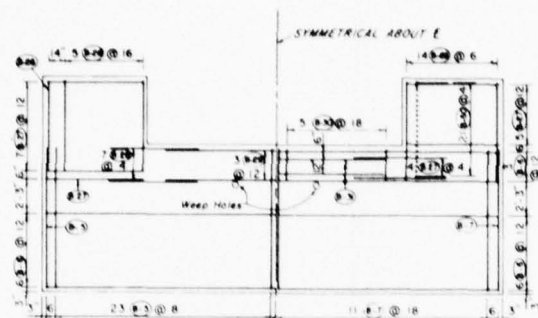
MIDDLE CREEK WATERSHED	
MULTIPLE PURPOSE DAM PA-637	
SNYDER COUNTY, PENNSYLVANIA	
HOIST AND GATE STEM LAYOUT	
U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
Designed by <i>L. Kimball &amp; Associates</i>	Date <i>5-67</i>
Checked by <i>C. CRISE</i>	Reviewed by <i>[Signature]</i>
Drawn by <i>[Signature]</i>	Scale <i>N. 20'</i>
Sheet <i>637</i>	Project No. <i>PA-637-P</i>



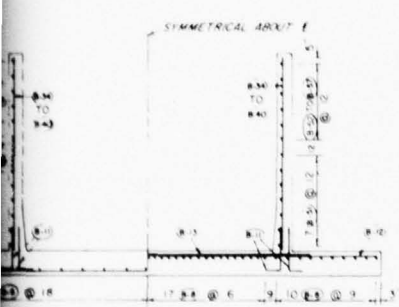
- NOTES**
1. For impact basin fence details see sht. 23
  2. For concrete summary see sht. 21
  3. For construction details, see sheet 13



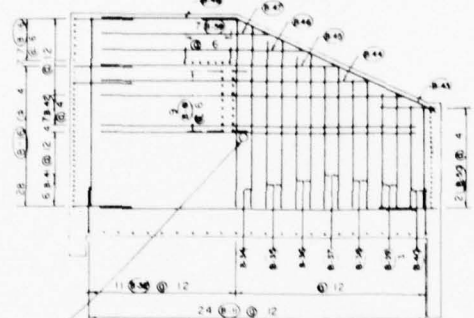
SECTION THRU BAFFLE UPSTREAM FACE



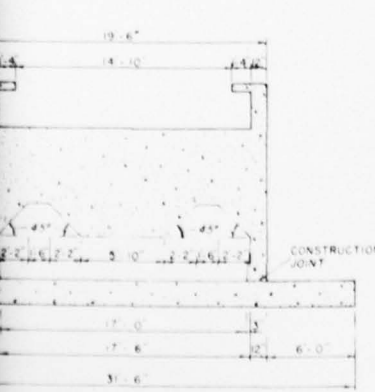
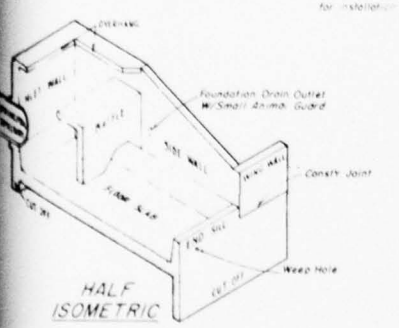
SECTION B-B UPSTREAM FACE



SECTION C-C INSIDE FACE



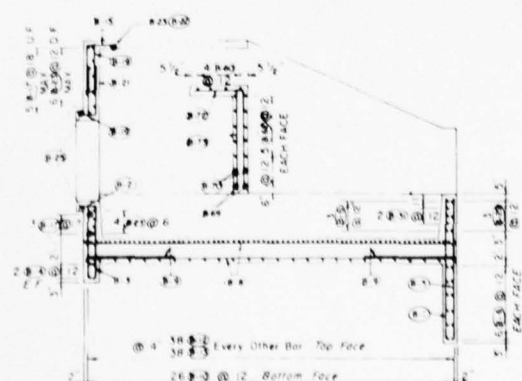
SECTION A-A OUTSIDE FACE



SECTION THRU BAFFLE

NOTES

1. For impact basin fence details see shft. 23
2. For concrete summary see shft. 21
3. For construction details, see sheet 13

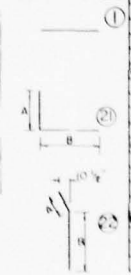


SECTION ALONG E

STEEL SCHEDULE

MARK	LOCATION	QUAN	SIZE	LENGTH	TYPE	A	B	TOTAL FT
B-1	CUT-OFF	36	5	2.6	1			95.00
2		44	5	5.0	1			220.00
3		15	5	6.0	1	21	5.0	124.00
4		4	5	31.0	1			124.00
B-5	CUT-OFF	48	5	9.6	1			456.00
6		15	5	31.0	1			465.00
7		23	6	9.6	1			218.50
8	FLOOR SLAB	74	6	25.0	1			1850.00
9		40	6	6.0	1			240.00
B-10		26	5	31.0	1			806.00
11		96	5	4.0	21	3.0	1-0	384.00
12		38	8	31.0	1			1178.00
13		38	8	22.0	1			836.00
14	INLET WALL	16	5	14.6	21	12.9	1-9	232.00
B-15		5	5	5.0	21	3.3	1-9	25.00
16		70	7	8.0	21	4.0	4-0	560.00
17		8	7	15.6	1			124.00
18		10	7	5.0	1			50.00
19		10	7	3.1	1			31.25
B-20		14	5	12.9	1			178.50
21		5	5	4.3	21	3.3	1-0	21.25
22		28	5	6.0	1			168.00
23		11	8	9.9	1			107.25
24		30	8	3.6	21	2.6	1-0	105.00
B-25		8	5	3.6	1			30.00
26	WING WALL	40	6	6.6	1			260.00
27		14	5	6.0	1			84.00
28	END SILL	3	7	15.0	1			45.00
29		10	5	2.9	1			27.50
B-30		2	6	15.0	1			30.00
31	SIDE WALLS	22	5	14.9	21	13.0	1-9	524.50
32		22	5	13.0	1			286.00
33		4	5	12.6	1			50.00
B-34		8	5	11.6	1			92.00
35		8	5	10.6	1			84.00
36		8	5	9.6	1			76.00
37		8	5	9.0	1			72.00
38		8	5	8.5	1			68.00
B-40		8	5	7.0	1			56.00
41		12	8	21.0	1			252.00
42		4	7	21.0	1			84.00
43		2	8	17.1	3	15.0	2-6	35.00
44		2	8	18.3	1			36.50
B-45		2	8	16.0	1			32.00
46		2	8	13.9	1			27.50
47		2	8	11.6	1			23.00
48		2	8	9.6	1			19.00
49		2	6	17.0	1	22	15.0	34.00
B-50		42	7	6.3	21	4.0	2-3	362.50
51		14	6	23.9	1			332.50
52		2	6	22.9	1			45.50
53		2	6	20.6	1			41.00
54		2	6	18.3	1			36.50
B-55		2	6	16.0	1			32.00
56		2	6	13.9	1			27.50
57		2	6	11.6	1			23.00
B-58		2	6	9.6	1			19.00
B-59	BAFFLE	14	4	6.9	21	5.9	1-0	94.50
60		4	4	10.0	1			40.00
61		36	5	6.9	21	5.9	1-0	243.00
62		10	5	10.8	1			106.67
63		4	5	9.9	21	6.3	3-6	39.00
64		4	5	8.9	21	5.3	3-6	35.00
65		4	5	8.0	21	4.6	3-6	32.00
66		4	5	6.3	1			25.00
67		4	5	5.3	1			21.00
68		4	5	4.6	1			18.00
69		2	5	6.0	1			12.00
B-70		2	5	8.0	1			16.00
71		8	5	3.6	1			28.00
72		6	5	10.3	21	6.3	3-6	61.50
73		6	5	6.9	1			40.50

BAR TYPES



QUANTITIES

REINFORCING STEEL BARS		
NO. 4 BARS	134.50 LIN FT	89.85 LBS
NO. 5 BARS	531.34 LIN FT	553.68 LBS
NO. 6 BARS	3.89 LIN FT	4790.63 LBS
NO. 7 BARS	1422.22 LIN FT	2360.40 LBS
NO. 8 BARS	2621.22 LIN FT	1078.84 LBS
CONCRETE	CLASS 4000	99.14 CU YDS
		TOTAL
		12,734.9 LIN FT
		20,464.1 LBS

MIDDLE CREEK WATERSHED  
MULTIPLE PURPOSE DAM PA-637  
SNYDER COUNTY, PENNSYLVANIA  
IMPACT BASIN DETAILS

U.S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

W.H. Lanning  
M. NIKOLICH  
T.O. PURKEY  
F.M. WYSONG

PA-637-P

DH 1, ELV. 606.1, 18+67, Centerline  
 Logged by: C. C. Johnson 2/23-25/66  
 Drilling Equipment: Sprague & Herwood 40C

		Unif.	STANDARD PENETRATION				SAMPLES		
Hole Depth		Soil	Type						
From	To	Class	B't				From	To	%
		Symb.	Used	Blows Per 6"	No.	Type	Ft.	Ft.	Rec.
0.0	0.4		Spt	1-3-7	-1	Jar	0.0	1.5	35
0.4	7.8	GC (SC)		5-7-12			1.5	3.0	0
				12-15-20	2	"	3.0	4.5	55
				27-31-37	3	"	4.5	6.0	45
				40-26-21	4	"	6.0	7.5	55
				21-27-11	5	"	7.5	9.0	75
7.8	11.0			17-21-29/0.1	6	"	9.0	10.3	70
			NCH				10.3	15.3	65
							15.3	20.3	82
11.0	30.0						20.3	25.3	100
							25.3	30.0	100
30.0									

DH 2, ELV. 606.8, 18+81, Centerline  
 Logged by: C. C. Johnson 2/25-31/66  
 Drilling Equipment: Sprague & Herwood 40C

Hole Depth From To		Description of Materials	Unif. Class Symb.	STANDARD PENETRATION			SAMPLES		
				Soil Type Symb.	Used	Blows Per 6"	No.	Type	From Feet
0.0	0.8	Forest litter, roots, small sandstone cobbles, etc.	SPt	1-3-3	1	Jar	0.0	1.5	25
			"	2-4-8	2	"	1.5	3.0	25
0.8	2.8	Recovered only rock fragments, poor sample recovery - trace of nonplastic fines.	GC	16-2-45	3	"	3.0	4.5	60
			"	8-18-27	4	"	4.5	6.0	35
2.8	8.5	Gravel, sandy & clayey; brn: moist, very poor samples about 60% gravel, 25% sand, 15% low plastic fines. Coarse particles angular, med. to fine grained sandstone.	GC	18-18-20	5	"	6.0	7.5	21
			"	28-60	6	"	7.5	8.5	50
			"				8.5	12.3	37
			"				12.3	17.3	76
			"				17.3	20.2	70
			"				20.2	24.5	40
			"				24.5	26.8	70
8.5	31.3	Shale, highly weathered, dk. gry with brn in bedding planes, largest piece of core is 1.1' long, moderately soft, 26.0-29.0' contains mostly very soft, clayey shale.	"				26.8	30.4	51
			"				30.4	31.7	100
			"				31.7	35.8	100
			"				35.8	38.6	32*
			"				38.6	49.5	71
			"				49.5	50.0	100
31.0	40.0	Shale same as above only in larger pieces (up to 0.4') and less weathered dip = 55°	"						
40.0	50.0	Shale, dk. gry, black on wet surface, hard to moderately hard, pieces of core up to 0.7' long, some brn stains in bedding planes.	"						
50.0		Bottom of boring (hole closed at 0.0', (1/10/66) no water)	"						
		*Lost diamond on bringing this core to surface							
		WL (1/7/66) 19.1' hole plugged at 26.0'							

DH 3, ELV. 605.4, 18+92, Centerline  
 Logged by: C. C. Johnson 1/1/66  
 Drilling Equipment: Sprague & Herwood 40C

Hole Depth		Description of Materials	Unif. Soil Class Symb.	STANDARD PENETRATION Soil Type Symb.	SPT Used	Blows Per 6"	No.	Type	SAMPLES		
From	To								From	To	%
0.0	0.5	Topsoil, roots, etc.		SPt	1-2-3	1	Jac	0.0	1.5	60	
0.5	2.5	Clay, silty, brn with gry mottling, no ss, trace of sand & gravel.	GC		5-2-7	2	"	1.5	3.0	60	
					8-2-15	4	"	3.0	4.5	60	
					21-24-19	"	"	4.5	6.0	43	
2.5	9.0	Gravel, sandy & clayey; brn to 5.0'; gry with red & brn fragments, wet, compact, 60% gravel, 25% sand, 15% low plastic fines, see TC #1.	GC		19-17-15	5	"	6.0	7.5	80	
					12-22-19	6	"	7.5	9.0	21	
					24-57-3	7	"	9.0	10.0	70	
				SL				10.0	14.8	70	
								14.8	17.5	100	
9.0	10.0	Shale, highly weathered, soft black.						17.5	24.3	100	
								24.3	29.3	100	
10.0	25.0	Shale, weathered, blk on moist surface, dk. gry on dry surface, largest piece of core is 0.2' long, moderately soft to moderately hard.						29.3	35.0	100	
25.0	35.0	Same as above only less weathered, pieces of core up to 0.5' long.									
35.0		Bottom of boring									
		WL (1/10/66) 0.0									

DH 4, ELV. 606.3, 18+80, Centerline  
 Logged by: C. C. Johnson 1/1/66  
 Drilling Equipment: Sprague & Herwood 40C

Hole Depth From To		Description of Materials	Unif. Soil Class Symbol	STANDARD PENETRATION				SAMPLES			
				Type Symb.	Used	Blows Per 6"	No.	Type	From Ft.	To Ft.	Rec.
0.0	0.4	Topsoil, roots, etc.		SPT		1-1-2	1	Jar	0.0	1.5	65
0.4	3.0	Clay, silty; brn with gry mottling, wet, 15% very fine sand.	CL	"		1-2-2	2	"	1.5	3.0	85
				"		21-21-12	3	"	3.0	4.5	20
				"		14-11-16	4	"	4.5	6.0	20
3.0	6.0	Gravel, sandy & silty; brn & gry; 60% gravel, 25% sand, 15% low plastic fines.	GC	"		9-13-20	5	"	6.0	7.5	60
				"		13-22-60/0.4	6	"	7.5	8.9	50
6.0	8.4	Sand, gravelly & clayey; gry, wet, compact, 40% gravel, 65% sand, 15% plastic fines, coarse particles are several colors.	SC		NX1				8.9	10.2	100
				"					10.2	19.8	100
				"					19.8	27.0	100
				"					27.0	32.0	100
8.4	8.9	Shale, weathered, soft, black									
8.9	32.0	Shale, slightly weathered, blk on wet surface, dk. gry on dry surface, moderately hard, bottom of boring									
32.0						WL (1/10/66)	0.0'				

DH 5, ELV. 609.3, 18+10, Centerline  
 Logged by: C. C. Johnson 3/4/66  
 Drilling Equipment: Sprague & Herwood 30C

STANDARD PENETRATION										SAMPLES	
Hole Depth		Description of Materials	Unif. Soil Class Symb.	Type Bit	SPT Used	Blows Per 6"	No.	Type	From To		
From	To								Feet	Feet	
0.0	0.5	Topsoil, roots, etc.	CT. (Mud)	SPT	1-1-1	1	Jar	0.0	1.5		
0.5	2.8	Clay, silty; gry with brn mottling, wet, 15% very fine sand.		2-3-7	2	"	1.5	3.0			
				5-7-9	3	"	3.0	4.5			
2.8	7.3	Gravel, sandy & clayey; gry, wet, compact, 55% gravel, 30% sand, 15% plastic fines, coarse particles are many colors and subround.	GC	NOM	11-16-25	4	"	4.5	6.0		
					16-20-26	5	"	6.0	7.5		
					32-60/0.4	6	"	7.5	8.4		
								8.4	11.2	1	
								11.2	17.5	1	
								17.5	23.1	1	
								23.1	30.0	1	
7.3	8.4	Shale, black, very soft, weathered.						*SA.1 Shel.	1.0	2.5	
8.4	20.0	Shale, dk. gry, weathered, moderately soft, pieces up to 0.3' long in bottom part, gravel size in top part.						*SA offset from DH 5			
20.0	30.0	Same as above with pieces of core up to 0.4' long.									
30.0		Bottom of boring			WL (3/7/66) +0.5'						

DH 6, ELV. 609.6, 18+80, Centerline  
 Logged by: C. C. Johnson 3/8/66  
 Drilling Equipment: Sprague & Herwood 30C

		Unif. Soil	STANDARD PENETRATION	SAMPLES			
		Type	Type				
Hole Depth		Class	SPT		From To		
From	To	Description of Materials	Symb.	Used	Blows Per 6" No. Type	Feet Feet	W
0.0	0.5	Topsoil, roots, etc.		SpT	1-2-3	1 Jar	0.0 1.5
0.5	5.9	Clay, silty & gravelly; brn & moist to 4.0', wet & gry-brn mottled below 4.0', 20' angular chert gravel, 15% fine sand.			3-4-4	2	1.5 4.0
					1-2-7	3	3.0 4.5
					9-15-18	4	4.5 6.0
					17-19-60/0.4	5	6.0 7.5
5.9	8.7	Gravel, sandy & clayey; brn & gry mottled, wet (compact) 60% gravel, 25% sand, 15% low plastic fines, coarse particles are subround to subangular & many colors.	GC			6	7.5 8.4
							8.4 10.7
							10.7 17.2
							17.2 25.0
							25.0 30.0
8.7	17.7	Shale, highly weathered, very soft, black with brn stains.					
10.7	30.0	Shale, slightly weathered, dk. gry, pieces of core up to 0.4' long, no iron stains in fractures or bedding planes.					
30.0		Bottom of boring					
		WL (3/9/66) slight flow					

DH 7, ELV. 614.2, 18+10, Centerline  
 Logged by: C. C. Johnson 1/8/66  
 Drilling Equipment: Sprague & Herwood 40C

Hole Depth		Description of Materials	Unif. Class Symb.	STANDARD PENETRATION		No.	Type	SAMPLES	
From	To			Soil Type	Blows Per 6"			From	To
0.0	0.4	Forest litter, roots, etc.	GC	SPt	5-6-8	1	Jar	0.0	1.5
0.4	3.0	Recovered only fine grained sandstone & shale gravel.	GC		7-10-16	2	"	1.5	3.0
					13-40-21	3	"	3.0	4.5
					20-40-13	4	"	4.5	6.0
					19-20-24	5	"	6.0	7.5
					22-20-57/0.4	6	"	7.5	8.9
3.0	21.5	Clay, sandy & gravelly; brn, moist, 20' fine gravel, 20' well graded sand, fines are low to moderately plastic, coarse particles are subround to subangular shale.	GC	SPt	9-10-10	7	"	8.9	15.4
					4-6-6	8	"	15.4	16.9
					4-6-6	9	"	16.9	18.4
					6-7-5	10	"	18.4	19.9
					7-6-6	11	"	19.9	21.4
21.5	24.5	Shale, weathered, soft.	GC					21.4	21.5
23.5	30.0	Brn & gry, wet compact. Shale, weathered, black on wet surface, dk. gry on dry surface, brn on bedding & fracture planes. All pieces of core 0.1' or less.	GC	SPt	21-21-42	12	"	21.5	23.0
								23.0	26.5
								26.5	29.7
								29.7	33.0
30.0	40.0	Same as above - less weathered pieces up to 0.3', no iron stains below 34.0'	GC					33.0	40.0
40.0		Bottom of boring							
		" 11/20/64 16.0'							

DN & ELEV. Sta. 1. 10+00, Centerline  
 Logged by: G. C. Johnson 3/9/66  
 Drilling Agent: Sprague & Hemwood 300

Hole Depth		Description of Materials	Unif.	STANDARD PENETRATION	SAMPLES					
From	To		Soil Class	Type	Used	Blows Per 5"	No.	Type	From To Ft.	K Rec.
0.0	0.5	Topsoil, roots, etc.		SPT	1-1-2		1	Jar	0.0 1.5	20
0.5	5.0	Clay, silty & gravelly; brn, moist, 20% fine gravel, 15% sand, coarse particles are subround to subangular.	CL		5-9-12		2	"	1.5 4.0	80
					9-12-18		"	"	4.0 4.5	75
					15-19-26		4	"	4.5 6.0	55
					12-18-18		5	"	6.0 7.5	45
5.0	9.0	Gravel, sandy & clayey; lt. red-brn, moist, 45% gravel, 30 sand, 25% plastic fines, coarse particles are subround to subangular & several colors.	GC		18-24-19		6	"	7.5 9.0	55
					9-9-12		7	"	9.0 10.5	65
					12-9-11		8	"	10.5 12.0	75
					3-5-8				12.0 13.5	0
					5-8-11				13.5 15.0	0
9.0	10.2	Sand, silty & clayey; lt. red-brn, wet (compact), 15% gravel 5% sand, 45% low plastic fines; coarse particles many colors, subround to subangular.	SM		12-23-50/0.3		9	"	15.0 16.3	25
									16.3 20.7	75
									20.7 24.8	100
									24.8 26.4	85
									26.4 28.0	100
16.2	20.5	Shale, dk. gray on dry surface, black on wet surface, weathered (lat core run moist gravel size pieces) thin bedded with brn stains in bedding planes & fractures, moderately soft.							28.0 31.4	100
									31.4 37.6	100
									37.6 42.0	100
20.5	42.0	Same as above with brn stains slightly larger pieces of core.								
42.0		Bottom of boring								
		TL (3/10/66) 12.5'								

Drill: 2, 41.8, 8+90, 95' D.S.  
 Forged by: W. C. Johnson 4/10/66  
 Drilling Equipment: Sprague & Herwood 300

Core Depth		Description of materials	Unif. Soil Class. Symb.	Type	CORRELATION DESIGNATION				SAMPLES		
From	To				Unit	Used	Blows Per Ft.	No.	Type	From	To
0.0	1.0	Topsoil, roots, etc.			SP	0-0-1	1	Jar	0.0	1.5	
1.0	14.0	clay, sandy & gravelly; lt. red-brn, moist, 25 chert gravel, 15 fine sand.	CL			0-7-11	2	"	1.5	4.0	
						14-18-20	3	"	4.0	6.5	
						15-16-22	4	"	4.5	6.0	
13.0	22.5	Sand, gravelly & clayey; brn. wet, 85 sand, 40 gravel, 15 low plastic fines, coarse particles subround & several rock types & colors.	SC			10-10-10	5	"	6.0	7.5	
						10-12-16	6	"	7.0	9.0	
						11-11-19	7	"	8.0	10.5	
						12-15-14	8	"	10.5	12.0	
						12-22-25	9	"	12.0	14.5	0
22.5	22.9	Shale, black, highly weathered, very soft.				21-25-18	9	"	13.5	15.0	
						16-12-30/0.1'	10	"	15.0	16.1	55
22.9	35.0	Shale, black, moderately soft, trace of brn. stains in top 2.0', largest piece of core is 0.3' long.		Tr		10-11-17	0	"	16.1	17.0	0
				Sp		10-15-15-17	11	"	17.0	19.0	35
						0-10-10-11		"	19.0	21.0	0
						10-12	12	"	21.0	22.0	0
35.0		Bottom of Boring				12-50/0.0	12	"	22.0	22.9	100
		CL (V11/6) 18.2'			EX	22-9	26.0	"	26.0	26.0	95
						21-0	29.7	"	29.7	7.0	55
						22-9	35.0	"	35.0	55	

File # 01, C.A. 105.8, 1+80, Centerline  
 Logged by: C. C. Johnson 2/2/06  
 Drilling Equipment: Sprague / Elmwood 405

Core Depth Feet		Description of Materials	Diff. Soil Class	QUANTITIES				VALUES		
From It.	To It.			Wt.	Vol.	Sp.	No.	Type	From It.	To It.
0.0	0.0	Topsoil, roots, etc. From		Sp.	1-1-2	1	Jar	0.0	1.5	75
0.0	3.0	Clit, sandv. lit. brn. moist,	0-25		3-2-8	2		1.5	3.0	95
		to fine to v. fine sand			3-11-8	4		3.0	4.5	50
3.0	5.8	Gravel, sandy & silty, brn.	60		2-7-8	4		4.5	6.0	40
		wet, 50 gravel, 35 sand,			9-4-6	5		6.0	7.5	40
		15% nonplastic fines, coarse			11-17-17	6		7.5	9.0	40
		particles are rounded to angular			14-17-30	7		9.0	10.5	20
					53	8		10.5	11.0	100
5.8	10.3	Gravel, sandy & clayey; dry,	60	EXT				11.0	14.8	75
		wet, 50 gravel, 45 sand, 15%						14.8	18.3	100
		low plastic fines.						18.4	22.2	100
		SEE TP 101 & 106 for log of						22.2	27.1	100
		this soil material						27.1	33.0	97
10.3	17.0	Shale, weathered, blk when wet								
		dk. dry on dry surface, core is								
		in pieces of 0.05' or less								
		thick plates hard & brittle, dip = 30° NW								
17.0	33.0	See as above with pieces of core up to 1.0' long, some calcite								
		filled fractures from 17.1-33.0								
33.0		bottom of boring			2.1 (2.29-2.4)	2.1				

See note on sheet 29

U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

Date		Approved by
Designed	<i>J. J. H. - [unclear]</i>	Title
Drawn	<i>L. E. Logart</i>	Title
Traced		Sheet
Checked		No. 25 of 29
		Drawing No. PA-637-P

DP 302, ELEV. 604.9, 17+80, 70' D.S.  
 Logged by: G. C. Johnson 2/25/66  
 Drilling Equipment: Sprague & Herwood 30C

Hole Depth From To	Description of Materials	Unif. Soil Class	STANDARD PENETRATION Type Bit	Used	Blows Per 6"	No.	Type	SAMPLES		
								From	To	%
								ft.	ft.	Rec.
0.0 0.5	Forest litter, roots, etc.	CL	SpT	1-1-1	1	Jar		0.0	1.5	70
0.5 4.0	Clay, silty & sandy; brn with gray mottling, wet, trace fine gravel, 25% well graded sand, gravel, sandy & clayey; gray, wet, 60% gravel, 25% sand, 15% low plastic fines.	CL	"	1-1-3	2	"		1.5	3.0	55
				4-0-6	3	"		3.0	4.5	20
				11-16-17	4	"		4.5	6.0	45
				18-18-15	5	"		6.0	7.5	60
				20-20-29	6	"		7.5	9.0	60
				21-35/0.4'	7	"		9.0	9.8	95
8.7 15.0	Shale, weathered, black, dk. dry on dry surface, moderately soft.	XXM						9.8	11.6	100
								11.6	15.0	100

WL (2/25/66) 0.3' JL (3/1/66) 0.0' flood conditions

DP 303, ELEV. 605.6, 17+83, 90' D.S.  
 Logged by: G. C. Johnson 2/25/66  
 Drilling Equipment: Sprague & Herwood 30C

Hole Depth From To	Description of Materials	Unif. Soil Class	STANDARD PENETRATION Type Bit	Used	Blows Per 6"	No.	Type	SAMPLES		
								From	To	%
								ft.	ft.	Rec.
0.0 0.3	Forest litter, roots, etc.	CL-XL	SpT	1-1-2	1	Jar		0.0	1.5	45
0.3 1.2	Clay, silty & sandy; brn, wet, 25% mostly fine sand	CL	"	1-2-2	2	"		1.5	4.0	55
				1-1-8	3	"		3.0	4.5	25
1.2 4.3	Sand, silty; brn, wet, 40% low plastic fines, sand is mostly fine & very fine.	S-1	"	12-11-11	4	"		4.5	6.0	70
				15-12-11	5	"		6.0	7.5	40
				18-20-15	6	"		7.5	9.0	60
				18-22-23	7	"		9.0	10.5	60
				55	8	"		10.5	11.0	100
9.3 9.3	Gravel, sandy & clayey; gray brn with grn & red partic- cles, wet, 60% gravel, 25% sand, 15% low plastic fines, coarse particles are subround to angular (shale & chert)	CL	"					11.0	14.1	75
								14.1	16.0	65
9.3 11.0	Shale, weathered, black, very soft							16.1	18.0	100
11.0 16.0	Shale, weathered, dk. gray to blk, moderately soft.							18.0	21.0	100

30A.1\* Shel. 1.0 2.5 1.0  
 \*Sample 30A.1 taken from offsite  
 hole.  
 WL (2/25/66) 2.5' JL (3/1/66) 1.5' flood stage

DP 304, ELEV. 605.2, 18+10, 130' D.S.  
 Logged by: G. C. Johnson 2/25/66 3/1/66  
 Drilling Equipment: Sprague & Herwood 30C

Hole Depth From To	Description of Materials	Unif. Soil Class	STANDARD PENETRATION Type Bit	Used	Blows Per 6"	No.	Type	SAMPLES		
								From	To	%
								ft.	ft.	Rec.
0.0 0.5	Forest litter, etc.		SpT	1-1-2	1	Jar		0.0	1.5	45
0.5 1.5	Clay, silty; brn, wet	CL	"	2-2-2	2	"		1.5	4.0	60
1.5 4.0	Sand, silty & clayey; brn, wet, 55% sand, trace gravel, fines are low plastic.	S-2	"	1-8-10	3	"		3.0	4.5	55
				2-3-21	4	"		4.5	6.0	40
				21-04-17	5	"		6.0	7.5	60
4.0 9.1	Gravel, sandy & clayey; gray with brn & red particles, wet, compact, 60% gravel, 25% sand, 15% low plastic fines - See log of TP 604.	CL	"	1-12-50	6	"		7.5	9.0	20
				18-21-46	7	"		9.0	10.5	40
				41-60/0.8	8	"		10.5	11.4	40
								11.4	17.0	65
9.1 11.0	Shale, highly weathered, black, soft, very thin beds.							17.0	20.5	100
11.0 17.0	Shale, weathered slightly blk. on moist surface, dk. dry on dry surface, core in places up to 0.2' dip = 45° moderately soft							20.5	27.0	100
17.0	Bottom of boring									

TP 601, ELEV. 621.0, 11+00, 80' D.S.

Hole Depth From To	Description of Materials	Unif. Soil Class	STANDARD PENETRATION Type Bit	Used	Blows Per 6"	No.	Type	SAMPLES		
								From	To	%
								ft.	ft.	Rec.
0.0 0.7	Topsoil, roots, etc.									
0.7 9.0	Clay, sandy & gravelly; lt. red-brn, moist, trace of cobbles (max. size 10'), 15% gravel, 20% sand, coarse particles are angular to subround, quartzite, sandstone and shale, soil is stiff.	CL						1	Bag	1.0 9.0
9.0	Shale, weathered, dk. gray									

TP 602, ELEV. 630.0, 10+50, 120' D.S.

Hole Depth From To	Description of Materials	Unif. Soil Class	STANDARD PENETRATION Type Bit	Used	Blows Per 6"	No.	Type	SAMPLES		
								From	To	%
								ft.	ft.	Rec.
0.0 0.6	Topsoil, roots, etc.									
0.6 4.0	Clay, silty, sandy & gravelly; brn, moist (frozen) trace of small cobbles, 20% gravel, 20% sand, coarse particles rounded.	CL						1	Bag	1.0 3.0
4.0 7.0	Cobbles & gravel, brn, wet, 50% cobbles, 40% gravel, 10% sand, trace of fines, maximum size = 10', coarse particles subround	CL						2	Bag	3.0 7.0
7.0	Bedrock - hole nearly full of water									

TP 603, ELEV. 640.0, 12+00, 150' D.S.

Hole Depth From To	Description of Materials	Unif. Soil Class	STANDARD PENETRATION Type Bit	Used	Blows Per 6"	No.	Type	SAMPLES		
								From	To	%
								ft.	ft.	Rec.
0.0 1.0	Topsoil, roots, etc.									
1.0 2.0	Clay, silty, brn with some gray mottling, moist, 15% sand,									
2.0 3.0	Gravel, sandy & clayey; brn with gray mottling, moist, trace of small cobbles (max. size 4') 45% gravel, 40% sand, 15% nonplastic fines, coarse particles angular and durable.	CL								
3.0 8.5	Gravel, sandy & silty; brn & gray mottled, wet, trace small cobbles (max. size 6'), 50% gravel, 45% sand, 15% nonplastic fines, coarse particles angular to subround and durable.	CL								
8.5 8.5	Gravel, sandy & clayey; brn in top 0.5-1.0'; gray below, 40% gravel, 30% sand, 30% plastic fines, very dense, coarse particles are many colors & compositions rounded to angular (chert). Bottom 1.5' slightly organic & black. Till?	CL								

Bottom of pit = bedrock WL (2/22/66) 1.0'

TP 604, ELEV. 604.8, 16+80, 150' D.S.

Hole Depth From To	Description of Materials	Unif. Soil Class	STANDARD PENETRATION Type Bit	Used	Blows Per 6"	No.	Type	SAMPLES		
								From	To	%
								ft.	ft.	Rec.
0.0 1.0	Topsoil, roots, etc.									
1.0 2.5	Clay, silty; dk. brn, moist, 15% sand - See sample #137.1									
2.5 8.5	Gravel, sandy & silty; brn to 5.0', gray below 5.0', wet but very impermeable & dense, 10% small cobbles (max. size 5'), 55% gravel, 30% sand, 15% low plastic fines. Water enters pit rapidly at top of this horizon.									
8.5 9.0	Shale, weathered, blk, beds vertical? beds 1/8-1/4" thick, hard & brittle.									
9.0	Bottom of pit WL (2/22/66) 2.5'									

DP 605, ELEV. 629.6, 10+60, 105' D.S.  
 Logged by: G. C. Johnson 3/10/61/66  
 Drilling Equipment: Sprague & Herwood 40C

Hole Depth From To	Description of Materials	Unif. Soil Class	STANDARD PENETRATION Type Bit	Used	Blows Per 6"	No.	Type	SAMPLES		
								From	To	%
								ft.	ft.	Rec.
0.0 0.5	Topsoil, roots, etc.		SpT	2-4-4	1	Jar		0.0	1.5	100
0.5 7.5	Clay, silty, sandy & gravelly; lt. red-brn, moist, 25% gravel, 15% sand, coarse particles are angular & many colors.	CL	"	4-5-7	2	"		1.5	3.0	4
				5-7-9	3	"		3.0	4.5	6
				9-12-13	4	"		4.5	6.0	7
				15-13-19	5	"		6.0	7.5	9
				15-12-26	6	"		7.5	9.0	10
				27-51	7	"		9.0	10.0	10
7.5 9.5	Sand, silty; brn, wet, 25% low plastic fines, trace of gravel, sand is mostly med. to very fine Same as from 0.5-7.5'	S-1	"	16-62-43/0.3'	8	"		10.0	11.7	11
								11.7	18.5	22
9.5 10.0	Shale, highly weathered, very soft, brn with blk & other colors.	XXM						18.5	22.0	22
10.0 10.5	Shale, highly weathered, very soft, brn with blk & other colors.							22.0	28.0	32
10.5 11.7	Shale, highly weathered, very soft, brn with blk & other colors.							28.0		
11.7 13.0	Shale, weathered, soft, brn with blk & other colors									
13.0 21.0	Shale, weathered, dk. gray to blk, moderately soft, brn stains in bedding planes, largest piece of core is 0.3', moist pieces are 1/4"									
21.0 42.3	Same as above with no brn stains									
42.3	Bottom of boring WL (3/14/66) 16.8'									

DP 606, ELEV. 610.6, 13+20, 105' D.S.  
 Logged by: G. C. Johnson 3/15/66  
 Drilling Equipment: Sprague & Herwood 40C

Hole Depth From To	Description of Materials	Unif. Soil Class	STANDARD PENETRATION Type Bit	Used	Blows Per 6"	No.	Type	SAMPLES		
								From	To	%
								ft.	ft.	Rec.
0.0 0.3	Topsoil, roots, etc.		SpT	4-0-5	1	Jar		0.0	1.5	1
0.3 10.2	Gravel, sandy & clayey; brn, moist, 40% gravel, 35% sand, 25% plastic fines, coarse particles are of many colors & sub- round to subangular. Be- comes gray & gray-gray at 9.0'	CL	"	17-16-20	2	"		1.5	3.0	3
				12-12-19	3	"		3.0	4.5	6
				15-17-21	4	"		4.5	6.0	7
				16-14-12	5	"		6.0	7.5	10
				14-28-28	6	"		7.5	9.0	10
				15-17-19	7	"		9.0	10.5	12
				23-47-63	8	"		10.5	12.0	13
				22-47-12	9	"		12.0	13.5	14
10.2 12.0	Clay, silty; gray-gray, wet (compact) varved, trace of fine gravel & sand.	CL	"	16-43-47/0.2'	9	"		13.5	14.7	20
								14.7	20.5	27
12.0 14.5	Gravel, sandy & clayey; gray-gray, wet (compact) 50% gravel, 45% sand, 25% plastic fines, coarse particles are many colors and angular (chert & shale) to subround (shale & sandstone)	CL	"							
14.5 14.7	Shale, weathered, blk, soft.									
14.7 27.0	Shale, blk on wet surface, dk. gray on dry surface, moderately soft, largest piece of core is 0.1', few stains in bedding planes or fractures, dip = 35°									
27.0	Bottom of boring JL (3/15/66) 5.1'									

DP 607, ELEV. 615.2, 12+00, 185' D.S.  
 Logged by: G. C. Johnson 4/15/66  
 Drilling Equipment: Sprague & Herwood 40C

Hole Depth		Description of Materials	Unif.	STANDARD PENETRATION	Used	Blows Per 6"	No.	Type	From	
From	To		Soil	Type					ft.	ft.
			Class	Bit						
0.0	0.5	Topsoil, roots, etc.		SpT	1-1-1	1	Jar		0.0	
0.5	3.0	Clay, silty; brn, moist, 15% fine sand.	CL	"	4-5-7	2	"		1.5	
					17-20-67	1	"		1.0	
3.0	7.0	Gravel, sandy & clayey brn, moist, 50% gravel, 5% sand, 15% plastic fines, coarse particles are subangular to subround and many colors. Some thin lenses of sandy CL.	GC	"	26-30-16	3	"		4.5	
					16-17-27	5	"		6.0	
					21-26-48	6	"		7.5	
					57-79	7	"		9.0	
7.0	10.0	Shale, dk. brn to blk, weathered, soft.								
10.0		Bottom of Boring	CL (3-16/66)	2.7'						

04. ELEV. 604.8, 16+80, 150' D.S.

1.0 Topsoil, roots, etc.  
2.5 Clay, silty; dk. brn, moist, 15% sand - See sample #117.1 CL  
8.5 Gravel, sandy & silty; brn to 5.0', wet but very permeable & domes, 10% small cobbles (max. size 5'), 55% gravel, 35% sand, 15% low plastic fines. Water enters pit rapidly at top of this horizon.  
9.0 Shale, weathered, blk, beds vertical? beds 1/8-1/4" thick, hard & brittle.  
Bottom of pit WL (2/22/66) 2.5'

05. ELEV. 629.6, 10+80, 105' D.S.

red by: G. E. Johnson 1/10/66  
filling Equipment: Sprague & Herwood 400

Depth ft.	Description of Materials	Unif. Soil Class	STANDARD PENETRATION				SAMPLES			
		Symbol	Type	At Used	Blows Per 6"	No.	Type	From ft.	To ft.	% Rec.
0.5	Topsoil, roots, etc.		SpT	2-4-4		1	Jar	0.0	1.5	65
7.5	Clay, silty, sandy & gravelly; lt. red-br., moist; 25% gravel, 15% sand, coarse particles are angular & many colors.	CL		4-5-7		2	"	1.5	3.0	70
				5-7-9		3	"	3.0	4.5	60
				9-12-13		4	"	4.5	6.0	55
				15-13-19		5	"	6.0	7.5	45
				15-12-24		6	"	7.5	9.0	45
9.5	Sand, silty; brn, wet, 25% low plastic fines, trace of gravel, sand is mostly med. to very fine	SM		27-53		7	"	9.0	10.0	25
			Tst	10-0		10.5				0
			SpT	16-62-43/0.3'		8	"	10.5	11.7	100
10.0	Same as from 0.5-7.5'	CL	MCU	11-7		18.5				100
10.5	Cobbles?					18.5				100
						22.0				100
11.7	Shale, highly weathered,					22.0				100
						28.0				100

06. ELEV. 610.6, 11+20, 105' D.S.

red by: G. E. Johnson 1/10/66  
filling Equipment: Sprague & Herwood 400

			STANDARD PENETRATION TEST			SAMPLES			
Depth m To	Description of Materials	Unif. Soil Class	Att Type	Used	Blows Per 6" No.	Type	From To		Rec.
							ft.	ft.	
0 0.3	Topsoil, roots, etc.		SPT	1-0-5	1	Jar	0.0	1.5	20
3 10.2	Gravel, sandy & clayey; brn, moist, 40% gravel, 15% sand, 25% plastic fines, coarse particles are of many colors & sub-round to subangular, becomes grv & grn-grv at 9.0'	GC		17-16-29	2	"	1.5	3.0	0
				12-12-14	2	"	3.0	4.5	30
				15-17-21	3	"	4.5	6.0	55
				16-13-12	4	"	6.0	7.5	60
				19-28-28	5	"	7.5	9.0	75
				15-17-19	6	"	9.0	10.5	85
				21-47-61	7	"	10.5	12.0	95
2 12.0	Clay, silty, grn-grv, wet (compact) varved, trace of fine gravel & sand.	CL		22-07-12	8	"	12.0	13.5	30
				16-41-47/0.2'	9	"	13.5	19.7	80
							19.7	27.5	100
							20.5	27.0	100
0 14.5	Gravel, sandy & clayey; grn-grv, wet (compact) 40% gravel, 15% sand, 25% plastic fines, coarse particles are many colors and angular (chert & shale) to subround (shale & sandstone)	GC							
5 18.7	Shale, weathered, blk, soft.								
7 27.0	Shale, blk on wet surface, dk. grv on dry surface, moderately soft, largest piece of core is 0.1', few stains in bedding planes or fractures, dip = 35°								
0	bottom of boring			WL (3/1/66) 5.1'					

07. ELEV. 615.2, 12+00, 185' D.S.

red by: G. E. Johnson 1/15/66  
filling Equipment: Sprague & Herwood 400

				<u>STANDARD PENETRATION TEST</u>				<u>SAMPLES</u>			
Depth from	Description of Materials	Unif. Soil Class	Type	Symbol	Used	Blows Per 6"	No.	Type	From		% Rec.
									ft.	ft.	
0	0.5	Topsoil, roots, etc.			Spr	1-1-3	1	Jar	0.0	1.5	65
5	9.0	Clay, silty; brn, moist, 10% fine sand	CL		"	4-5-7 17-20-47	2 3	"	1.5 3.0	1.0 3.0	55 65
0	7.0	Gravel, sandy & clayey; brn, moist, 50% gravel, 15% sand, 15% plastic fines, coarse particles are subangular to subround and many colors. Some thin lenses of sandy CL	GC		"	26-49-46 15-17-27 21-26-45	4 5 6	"	4.5 6.0 7.5	6.0 7.5 9.0	40 70 95
					"	57-79	7	"	9.0	10.0	80
0	10.0	Shale, dk. brn to blk, weathered, soft.									
0		Bottom of Boring	CL	(3/16/66)	2.7'						

# Summary of Field Permeability Tests

Hole No.	Type of Test	Depth of Test (ft.)	Permeability (ft./day)
1	Packer	4.5- 6.0	Essentially zero
	"	6.0- 7.5	Essentially zero
	Pressure	11.0-16.0	45.0*
	"	15.0-20.0	2.2
2	Holding	20.0-25.0	Essentially zero
	Packer	6.0- 7.5	1.1
	"	7.5- 8.5	0.2**
	"	8.5-17.3	5.6
3	Pressure	9.0-14.0	24.1*
	"	14.0-19.0	16.4*
	"	19.0-24.0	8.6
	"	24.0-29.0	7.7
4	"	29.0-34.0	17.0*
	"	34.0-39.0	0.4
	Packer	3.0-10.0	Essentially zero
	"	10.0-35.0	0.3
5	Pressure	13.0-18.0	0.3
	"	18.0-23.0	1.1
	"	23.0-28.0	0.6
	Holding	28.0-33.0	Essentially zero
6	Packer	3.0- 4.5	19.0
	"	4.5- 6.0	0.4
	Pressure	6.0- 7.5	Essentially zero
	"	8.5-14.5	Essentially zero
7	"	12.0-17.0	0.2
	"	17.0-22.0	0.2
	"	22.0-27.0	0.9
	"	27.0-32.0	0.6
8	Packer	3.0- 6.0	Essentially zero
	"	6.0- 8.4	0.3**
	Pressure	9.0-14.0	5.0
	"	13.5-18.5	7.1
9	"	18.5-23.5	2.5
	"	23.5-28.5	0.01
	Packer	3.0- 4.5	Essentially zero
	"	4.5- 6.0	Essentially zero
10	"	6.0- 7.5	Essentially zero
	"	6.0- 8.9	Essentially zero
	"	9.5-14.5	0.2
	"	14.0-19.0	0.01
11	"	19.0-24.0	24.2
	"	24.0-29.0	0.4
	Packer	6.0- 7.5	Essentially zero
	"	8.0-13.9	2.8
12	"	13.9-15.4	Essentially zero
	"	16.9-18.4	1.1
	"	21.5-23.0	0.1
	Pressure	23.0-28.0	24.8
13	"	28.0-33.0	3.1
	"	33.0-38.0	0.5
	Packer	3.0-16.3	Essentially zero
	"	16.4-20.7	0.6
14	Pressure	20.7-26.4	0.3
	"	16.5-21.5	1.6
	"	20.5-25.5	0.2
	"	25.5-30.5	0.2
15	"	30.5-35.5	2.0
	"	35.5-40.5	1.1
	Packer	3.0- 6.0	Essentially zero
	"	6.0-12.0	Essentially zero
16	"	12.0-19.0	Essentially zero
	"	22.9-35.0	2.1
	Packer	6.0- 7.5	0.6
	"	7.5- 9.0	0.5
17	"	9.0-10.5	1.3**
	"	11.2-12.0	Essentially zero
	Pressure	12.0-17.0	6.8*
	"	16.5-21.5	20.8*
18	"	22.0-27.0	0.6
	Holding	27.0-32.0	Essentially zero
	Packer	6.0- 7.5	Essentially zero
	"	7.5- 9.0	Essentially zero
19	"	9.8-15.0	Essentially zero
	Packer	6.0- 9.0	0.3**
	"	9.0-10.5	Essentially zero
	"	11.0-16.0	1.8
20	Packer	4.5- 6.0	Essentially zero
	"	7.5- 9.0	Essentially zero
	"	10.0-11.7	0.3
	Pressure	12.0-17.0	0.1
21	"	16.0-21.0	1.2
	"	21.0-26.0	3.4
	"	26.0-31.0	1.3
	Packer	4.5- 6.0	Essentially zero
22	"	7.5- 9.0	1.9
	"	9.0-10.5	Essentially zero
	"	10.5-12.0	Essentially zero
	"	12.0-13.5	0.4
23	"	13.5-14.7	Essentially zero
	Pressure	16.0-21.0	21.6
	"	21.0-26.0	0.1

\*Apparent leak in system \*\*Test does not meet all requirements for accurate determination of permeability.

All stations are referenced to the baseline.

See note on sheet 22.

MIDDLE CREEK WATERSHED MULTIPLE PURPOSE DAM PA-637 SNYDER COUNTY, PENNSYLVANIA LOGS OF DRILL HOLES AND TEST PITS U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
Designed by: <i>G. E. Johnson</i>	Date: <i>1-27-66</i>
Drawn: <i>G. E. Johnson</i>	Approved by: _____
Field: _____	Title: _____
Checked: _____	Sheet: <i>26</i> of <i>29</i>
	Drawing No: <i>PA-637-P</i>

L. ROBERT KIMBALL & ASSOCIATES  
CONSULTING ENGINEERS & ARCHITECTS

FIGURE 1A

TP 101, ELEV. 724.6, -6+80, 225' U.S.

0.0 0.7 Topsoil, roots, etc.  
0.7 8.0 Clay, gravelly & sandy; lt. brn, moist, trace of cobbles (max. size 5").  
8.0 Bottom of pit - dry hole - bedrock?

TP 102, ELEV. 686.9, -4+80, 400' U.S.

0.0 0.8 Topsoil, roots, etc.  
0.8 5.0 Clay, gravelly & sandy; lt. brn, moist, trace of cobbles (max. size 6").  
5.0 8.5 Shale, weathered, soft, gray with several other colors. Excavates easily  
8.5 Bottom of pit - dry hole

TP 103, ELEV. 720.5, -4+60, 630' U.S.

0.0 1.1 Topsoil, roots, etc. (not very organic)  
1.1 6.0 Clay, gravelly & sandy; lt. brn, moist, 30% gravel, 15% sand, CL (GC-GM)  
6.0 10.0 Gravel, sandy & clayey; tan, wet, 5% gravel, 4% sand, 2%  
Bottom of pit - dry hole

TP 104, ELEV. 740.4, -1+55, 905' U.S.

0.0 0.6 Topsoil, roots, etc.  
0.6 4.5 Clay, gravelly & sandy; lt. brn, moist, trace of small cobbles, 30% gravel,  
4.5 11.0 Sand, gravelly & silty; lt. brn, moist, trace of small cobbles (max.  
11.0 Bottom of pit - dry hole

TP 105, ELEV. 607.5, -1+10, 510' U.S.

0.0 0.8 Topsoil, roots, etc.  
0.8 8.0 Clay, gravelly & sandy; lt. brn, moist, 5% small cobbles (max.  
8.0 Bottom of pit - bedrock? - shown at base of pit.

TP 106, ELEV. 700.0, -4+25, 830' U.S.

0.0 0.7 Topsoil, roots, etc.  
0.7 1.5 Clay, gravelly & sandy; brn, moist; 10% gravel, 15% sand, 5% plastic  
1.5 3.5 Gravel, brn, moist, 10% gravel, 15% sand, 5% plastic  
3.5 9.0 Shale, weathered, very soft, gray with several other colors, dipping  
9.0 Bottom of pit - dry hole

TP 107, ELEV. 787.5, -5+45, 1160' U.S.

0.0 0.7 Topsoil, roots, etc.  
0.7 6.0 Sandstone, weathered, hard lt. brn, moist with layers of chert (very hard)  
6.0 Bottom of pit - dry hole

TP 108, ELEV. 755.0, -4+75, 1245' U.S.

0.0 0.5 Topsoil, roots, etc.  
0.5 4.5 Clay, gravelly & sandy; lt. brn, moist, trace of small cobbles (max. size 6")  
4.5 10.5 Sand, gravelly & silty; brn with some red-bn strata, trace of soft sandstone  
10.5 Bottom of pit - dry hole

TP 109, ELEV. 760.1, -5+65, 1305' U.S.

0.0 0.8 Topsoil, roots, etc.  
0.8 6.0 Clay, gravelly & sandy; lt. brn, moist, trace of small cobbles, 15% gravel,  
6.0 Sandstone, weathered, hard, lt. brn fossiliferous. Bottom of pit - dry hole.

TP 110, ELEV. 717.3, -4+80, 1215' U.S.

0.0 0.5 Topsoil, roots, etc.  
0.5 4.0 Gravel, sandy & clayey; lt. brn, moist, trace of small cobbles, 60% gravel,  
4.0 6.0 Gravel, brn, moist, 10% cobbles (max. size 6"); matrix is 5% well graded  
6.0 8.0 Sandstone, weathered, hard, lt. brn, excavates as gravel & cobbles, 50%  
8.0 Bottom of pit - dry hole

TP 111, ELEV. 722.9, -6+60, 2050' U.S.

0.0 0.8 Topsoil, roots, etc.  
0.8 2.5 Gravel, sandy & clayey; lt. brn, moist, 10% cobbles (max. size 6")  
2.5 8.5 Clay, gravelly; lt. brn, moist, 10% cobbles (max. size 6") 20% gravel  
8.5 Bottom of pit - bedrock?

TP 112, ELEV. 665.9, -4+55, 2085' U.S.

0.0 0.7 Topsoil, roots, etc.  
0.7 3.0 Gravel, sandy & clayey; lt. brn, moist, trace of small cobbles (max.  
3.0 9.0 Sand, gravelly & clayey; lt. brn, moist, 10% durable chert gravel,  
9.0 Bottom of pit - dry hole.

TP 113, ELEV. 670.9, -2+75, 1835' U.S.

0.0 0.8 Topsoil, roots, etc.  
0.8 8.0 Shale, weathered, soft, black on fresh surface, brn coating that  
8.0 Bottom of pit - dry hole.

TP 114, ELEV. 700.6, -2+20, 1390' U.S.

0.0 1.1 Topsoil, roots, etc.  
1.1 6.5 Clay, sandy & gravelly; lt. brn with some lt. grn, moist, 25% shale  
6.5 9.0 Siltstone, grayish (brn on weathered surface) moist, soft, excavates  
9.0 Bottom of pit - dry hole

TP 115, ELEV. 606.0, 0+45, 1065' U.S.

0.0 0.6 Topsoil, roots, etc.  
0.6 8.0 Clay, gravelly & sandy; lt. brn, moist, trace of small cobbles, 15%  
8.0 10.0 Shale, weathered, soft, black on fresh surface, brn & gray on weathered  
10.0 Bottom of pit - dry hole.

TP 116, ELEV. 106.0, 1+00, 1175' U.S.

0.0 0.8 Topsoil, roots, etc.  
0.8 6.0 Clay, gravelly & sandy; lt. brn, moist, trace of small cobbles, 20%  
6.0 10.0 Shale, weathered, soft, grayish, wet, excavates as cobbles & gravel  
10.0 Bottom of pit - dry hole

TP 118, ELEV. 121.0, 12+0, 1175' U.S.

0.0 0.8 Topsoil, roots, etc.  
0.8 4.0 Clay, sandy & gravelly; lt. brn, moist, 20% gravel, 15% sand, 65%  
4.0 9.0 Gravel, sandy & clayey; brn with some gray, moist above 6.0', wet  
9.0 10.0 Clay, silty, gray, wet, very plastic, weathered shale.  
10.0 Bottom of pit - dry hole

TP 119, ELEV. 20.2, 12+00, 2050' U.S.

0.0 0.8 Topsoil, roots, etc.  
0.8 3.0 Clay, sandy & gravelly; lt. brn, moist, 20% gravel, 15% sand, 65%  
3.0 7.0 Gravel, sandy & clayey; brn, moist, 5% cobbles (max. size 6"); matrix  
7.0 7.5 Sandstone, dk. gray to black on fresh surface, lt. gray on weathered  
7.5 Bottom of pit - dry hole

TP 120, ELEV. 25.0, 12+55, 2200' U.S.

0.0 0.7 Topsoil, roots, etc.  
0.7 7.5 Gravel, sandy & clayey; lt. brn with some gray above 4.5', brn below  
7.5 Bedrock - Bottom of pit

0.8	Topsoil, roots, etc.	
2.5	Gravel, sandy & clayey; lt. brn, moist, 10% cobbles (max. size 6") 50% gravel, 20% sand, 10% plastic fines, coarse particles are angular durable chert & sandstone.	GC
8.5	Clay, gravelly; lt. brn, moist, 10% cobbles (max. size 6") 20% gravel, 15% sand, 65% plastic fines, coarse particles are angular, durable chert. Bottom of pit = bedrock?	CL

0.7	Topsoil, roots, etc.	
3.0	Topsoil, sand & clayey; lt. brn, moist, trace of small cobbles (max. size =) 45% gravel, 20% sand, 45% plastic fines, coarse particles are angular & durable sandstone & chert.	1
9.0	Sand, gravelly & clayey; lt. brn, moist, 10% durable chert gravel, 20% plastic fines.	3C
	Bottom of pit - dry hole.	

8.0 Shale, weathered, soft, black on fresh surface, brown coating that gradually disappears with depth, excavates as gravel and trace of sand, angular, nondurable. Dip is difficult to determine, mostly vertical, some beds dipping steeply into hillsides. Bottom of pit = dry hole.

1.1 Topsoil, roots, etc.  
6.5 Clay, sandy & gravelly; 1% brown with some lt. gr., moist, 2% shaly  
9.0 Silty-sand, nondurable gravel, 1% shaly gravel, (3) plastic fines.  
Silty-sand, gray-ry (brown) on weathered surface, silty, soft, excavates  
as angular cobbles & gravel (max. size 4") 2% cobbles, 1% gravel.  
Bottom of pit = dry hole

9.0	Topsoil, roots, etc.	
8.0	Clay, gravelly & sandy; lt. brn, moist, trace of small cobbles, 0 gravel, 15% sand, coarse part close are angular, durable, chert and sandstone.	Co
10.0	Shale, weathered, soft, black on fresh surface, brn & gray on weathered surface, excavates as gravel with about, 15% sand, trace of fines, bottom of pit = dry hole.	Br

9.8	Topsoil, roots, etc.	
9.9	Clay, brown & sandy; lt. brn. soil, trace of small cobbles, 25% gravel, 20% sand, 55% plastic fines. coarse particles are shaly, angular nonbondable.	20
10.0	Shale, weathered, soft, gray-bn, wet, excavated as cobbles & gravel, 55% incl. fine, silty clay, inter laminar from shale, bottom of pit is bedrock soil.	

0.8	Topsoil, roots, etc.	
0.0	Clay, sandy & gravelly; lt. brn, moist, 2% gravel, 1% sand, 1% plastic & mica; clay plate clay are angular to subangular, durable sheet & sandstone fragments.	2
0.0	Gravel, sandy & clayey, brn with some grv, moist above 6.0', wet below 6.0'; 5% subangular clay, 10% lt. brn, 10% to gravel, 2% sand, and 2% plastic fines, major particles are durable, angular sheet and sandstone fragments.	2
10.0	Clay, silty, brn, wet, very plastic, weathered shale.	2

9.8 Topsoil, roots, etc.  
9.3 Clay, sandy a gravelly; lt. brown, moist, 21% gravel, 15% sand, 64% plastic fines, coarse particles are angular, durable clasts.  
7.0 Gravel, sandy, light brown, moist, 8% cobble, 5% sand, 87% matrix is 5% gravel, 25% sand, 25% plastic fines, coarse particles are angular and durable clasts and sandstone fragments.  
7.9 Siltstone, dk. gray to black on fresh surface, lt. gray on weathered surface bottom of pit 3, (2-18/64) 7.0%

0.7 Topsoil, roots, etc.  
7.4 Gravel, sandy & clayey; lt. brn with some gray above 4.5', brn below 4.5', moist, 50% gravel, 25% sand, 25% plastic fines, coarse particles are mostly drabbe sandstone and chert, some nondrable shale.  
Bedrock Bottom of pit D. (2/18/66) 7.7's

0.0	0.7	Topsoil, roots, etc.	
0.7	5.0	Clay, sandy & gravelly; lt. brn with some gry. 25% gravel, 15% sand, 60% CL	
		plastic fines, coarse particles are angular and durable.	
5.0	8.0	Gravel, sandy & clayey, brn, moist above 6.5', wet below 6.5'. 50% gravel, GC	
		25% sand, 25% plastic fines, coarse particles are mostly durable.	
8.0		Bottom of pit, bedrock	TL (2/18/66) 6.5'±

0.0	0.8	Topsoil, roots, etc.	
0.8	3.5	Clay, gravelly & sandy; lt. brn with some lt. and dk. gry. moist; 50% CL	
		Gravel, 15% sand, coarse particles angular and durable.	
3.5	8.5	Gravel, sandy, clayey brn, moist above 5.0', wet below 5.0', 50% GC	
		Gravel, 25% sand, 25% plastic f. fine, coarse part. clea angular and durable.	
8.5		bedrock Bottom of pit 10' (2/18/64) 5.0'±	

0.0	0.8	Topsoil, roots, etc.	
0.8	3.0	Clay, gravelly and sandy; lt. brn with some gray mottling, moist, 30% gravel, 15% sand, coarse particles are angular and durable.	CL
3.0	8.0	Gravel, sandy and clayey; brn, moist, wet below 5.0', 50% gravel, 25% sand, 25% plastic fines, coarse particles are angular and durable.	GL
8.0	8.5	Shale, poor samples	
1.5		Bottom of pit.	

0.9	7.7	Topsoil, roots, etc.	
7.7	5.0	Gravel, sandy and clayey; bra, moist, 5% gravel, 35% sand, 15% plastic fines, coarse particles are angular and durable.	GC
5.0	7.5	Gravel, sandy and silty; ben, wet, 5% gravel, 45% sand, 15% nonplastic fines, trace of small cobbles (max. size 4"); coarse particles are sub-round and durable (mostly sandstone)	GM
7.5		bottom of pit, bedrocks	7. (2/18/64) 5.0*

0.7	0.7	Topsoil, roots, etc.	
2.7	2.5	Gravel, sandy and clayey: brn, moist, 50% gravel, 45% sand, 15% plastic fines, coarse particles are durable and angular.	02
2.5	7.5	Gravel, sandy & silty, brn, wet, trace small cobbles, coarse particles are subround and durable.	04
7.5		bottom of pit, bedrock	11 (2/18/66) 2.5' ±

1.0	1.6	Topsoil, roots, etc.	
1.6	8.0	Clay, silty and sandy; ben and gro, w-t, 15' mostly fine sand.	25'
8.0	7.0	Gravel, sandy and silty; ben, wet, 55' gravel, 10' sand, 15' nonplastic fines, coarse particles are round and durable.	64'
7.0		bottom of pit	71 (2.18/2.0) 6.074

1.0	1.0	Topsoil, roots, etc. Top 0.5' frozen	
1.0	5.0	Clay, silt, and sandy silt with some grey mottling, moist, 15% sand, mostly 2	
		fine.	
5.0	2.0	Gravel, sandy and silty; hrs, wet, trace of cobbles (max. size 1"), 50	6.0
		gravel, 25% sand, 15% nonplastic fines, coarse particles rounded and	
		durable.	
1.0		Bottom of pit, black platy shale	7. (2/21/74) 5.0

3.1	1.3	Topsoil, roots, etc. Top 3" of frozen	
1.1	5.0	Gravel, sandy & clayey; brn, moist, 50 gravel, 40 sand, 2% plastic fines, coarse particles subround to subangular, durable.	62
0.0	0.0	Gravel, sandy and silty; gray, wet, 1 small cobble (max. size 6") matrix (is 50 gravel, 15 sand, 1% nonplastic fines, coarse particles rounded and durable.	63
0.0		Bottom of pit 31 (2.21/61) 0.0%	

See note on sheet 29

2

TP 129, ELEV. 608.6, 15+60, 1045' U.S.

0.0 1.0 Topsoil, roots, etc. Top 0.6' frozen  
1.0 3.5 Gravel, sandy and clayey; brn, some gry coloring, moist, 50% gravel, 25% sand, 25% plastic fines, coarse particles subangular to subround, durable. GC  
3.5 6.5 Gravel, sandy and silty; gry, wet, 10% small cobbles (max. size 6"); matrix is 60% gravel, 25% sand, 15% nonplastic fines, coarse particles subround and durable. GM  
6.5 Bottom of pit WL (2/21/66) 3.5'±

TP 130, ELEV. 611.2, 15+90, 1040' U.S.

0.0 1.0 Topsoil, roots, etc.  
1.0 2.7 Gravel, sandy and clayey; brn, some lt. gry coloring, moist, 50% gravel, 25% sand, 25% plastic fines, coarse particles angular to round durable. GC  
2.7 7.0 Gravel, sandy and silty; gry, wet, 10% small cobbles (max. size 6"); matrix is 50% gravel, 35% sand, 15% nonplastic fines, coarse particles mostly rounded and durable. GM  
7.0 Bottom of pit WL (2/21/66) 2.7'±

TP 131, ELEV. 609.6, 15+90, 1250' U.S.

0.0 1.0 Topsoil, roots, etc.  
1.0 2.0 Gravel, sandy and clayey; brn with gry mottles, 45% gravel, 25% sand, 30% plastic fines, coarse particles. GC  
2.0 6.5 Gravel, sandy and silty; gry, wet, 10% small cobbles (max. size 7"); matrix is 50% gravel, 35% sand, 15% nonplastic fines, coarse particles rounded and durable. GM  
6.5 Bottom of pit WL (2/21/66) 2.5'±

TP 132, ELEV. 610.3, 17+90, 1250' U.S.

0.0 0.7 Forest litter, etc.  
0.7 3.0 Gravel, sandy and clayey; brn with gry mottles, moist, 40% gravel, 30% sand, 30% plastic fines, coarse particles are subround to angular and durable. GC  
3.0 10.5 Gravel, sandy and silty; gry, wet, 10% small cobbles (max. size 6"); matrix is 40% gravel, 25% sand, 15% nonplastic fines, coarse particles are mostly rounded and durable. GM  
10.5 Bottom of pit WL (2/21/66) 3.0'±

TP 143, ELEV. 639.3, 10+05, 605' U.S.

0.0 0.8 Topsoil, roots, etc.  
0.8 8.0 Gravel, sandy and clayey; brn to 5.0', lt. brn below 5.0', moist to 7.0', wet below 7.0', trace of small cobbles (max. size 4") 45% gravel, 30% sand, 25% plastic fines, coarse particles are angular chert and sandstone GC  
8.0 Bottom of pit bedrock? WL (2/22/66) 7.0'±

TP 149, ELEV. 618.0, 11+75, 605' U.S.

0.0 0.9 Topsoil, roots, etc.  
0.9 6.5 Gravel, sandy and clayey; brn, moist, trace of small cobbles, 45% gravel, 30% sand, 25% plastic fines, most coarse particles angular and durable, trace of shale. GC  
6.5 8.5 Clay, sandy and gravelly; gry wet, 15% gravel, 30% sand, 55% plastic fines, coarse particles are subround to angular. CL  
8.5 Bottom of pit-bedrock? WL (2/22/66) 8.5'±

TP 145, ELEV. 609.5, 11+80, 605' U.S.

0.0 1.1 Topsoil, roots, etc.  
1.1 3.5 Clay, silty; gry, slightly organic, moist, 10% sand CL  
3.5 5.0 Gravel, sandy and clayey; brn, moist, wet and gry below 5.0' (pit caved in to 5.0' from top before depth could be measured), 45% gravel, 30% sand, 25% plastic fines, coarse particles are angular and durable. GC  
10.0 Approximate bottom of pit WL (2/22/66) 5.0'±

TP 146, ELEV. 607.7, 13+70, 450' U.S.

0.0 0.7 Topsoil, roots, etc.  
0.7 3.0 Clay, silty; brn with some lt. gry mottling, moist, 15% sand CL  
3.0 5.0 Gravel, sandy and clayey; brn with gry mottling, moist, trace of small cobbles, (max. size 4") 45% gravel, 25% sand, 30% plastic fines, coarse particles are angular and durable, chert and sandstone GC  
5.0 8.5 Gravel, sandy and silty; gry, wet, 50% gravel, 35% sand, 15% nonplastic fines GM  
8.5 Bottom of pit - bedrock WL (2/22/66) 5.0'±

TP 147, ELEV. 607.4, 13+75, 250' U.S.

0.0 0.6 Topsoil, roots, etc.  
0.6 1.5 Clay, silty; brn with some gry mottling, moist, 15% sand CL  
1.5 5.0 Gravel, sandy and clayey; brn and gry mottled, moist to 3.5', wet below 3.5', trace of small cobbles, 45% gravel, 25% sand, 30% plastic fines, coarse particles angular and durable. GC  
5.0 7.5 Gravel, sandy and silty; gry, wet, 10% small cobbles (max. size 5"), matrix is 50% gravel, 35% sand, 15% nonplastic fines, coarse particles angular to subround. GM  
7.5 Bottom of pit - bedrock WL (2/22/66) 3.5'±

TP 148, ELEV. 607.0, 11+80, 250' U.S.

0.0 1.0 Topsoil, roots, etc.  
1.0 3.0 Clay, silty; brn with gry mottling, moist, 15% sand. CL  
3.0 7.5 Gravel, sandy and clayey; brn with gry mottling, wet, trace of small cobbles, 45% gravel, 25% sand, 30% plastic fines, coarse particles angular and durable. GC  
7.5 8.5 Gravel, sandy and silty; gry, wet, 10% small cobbles (max. size 6"); matrix is 50% gravel, 35% sand, 15% nonplastic fines. GM  
8.5 Bottom of pit - bedrock WL (2/22/66) 3.0'±

TP 201, ELEV. 659.5, 6+40, 210' U.S.

0.0 1.2 Topsoil (plow-layer) roots, etc. not very organic  
1.2 6.5 Clay, sandy and gravelly; lt. brn, moist, trace of cobbles 15% gravel, 20% sand, 65% very plastic fines, coarse particles sandstone, chert and some shale, durable for the most part GM  
6.5 11.5 Shale, weathered, gry with many other colors present, some gravel and sand and trace of plastic fines, moist, 50% platy sand, particle strength soft, definitely nondurable easily with backhoe.  
11.5 Bottom of pit - shale dips about 45° downhill - Dry

TP 202, ELEV. 646.4, 7+70, 235' U.S.

0.0 0.7 Topsoil, roots, etc.  
0.7 6.0 Clay, sandy and gravelly; lt. brn, moist, 15% gravel, CL 20% sand, coarse particles are soft to very soft, angular, nondurable shale fragment, some coarse particles are lumps of shale that can be crushed to a CL in fingers.  
6.0 11.0 Shale, highly weathered, soft, brn, moist, excavates as a GC with a trace of cobbles, 40% gravel, 25% sand, 35% plastic fines, coarse particles are angular and soft to very soft, nondurable.  
11.0 12.0 Shale, weathered, slightly harder than the shale described above, brn with black stains in bedding planes bedding is contorted but generally dip downhill at about 5° GP  
12.0 Bottom of pit - dry hole.

TP 203, ELEV. 651.8, 7+00, 160' U.S.

0.0 0.8 Topsoil, roots, etc.  
0.8 6.0 Clay, sandy and gravelly; lt. brn, moist, 15% gravel, 20% sand, coarse particles are shale, soft, angular and nondurable particles can be crushed to CL with fingers.  
6.0 9.5 Shale, highly weathered, soft, brn, moist, excavates as a GC with a trace of cobbles, 40% gravel, 25% sand, 35% plastic fines, coarse particles are soft to very soft, angular nondurable.  
9.5 10.5 Shale, weathered, soft, gry-brn with black stains in bedding excavates as small cobbles and gravel, 50% each with a trace of fines.  
10.5 Bottom of pit - dry hole.

TP 204, ELEV. 652.0, 6+80, Centerline

0.0 0.8 Topsoil, roots, etc.  
0.8 6.0 Clay, gravelly and sandy; lt. brn, moist, 25% gravel, 20% sand, plastic fines, coarse particles are angular, durable chert Siltstone, weathered, limestone in top 1.0', slightly liney excavates as cobbles (max. size 11") gry-brn.  
6.5 8.5 Bottom of pit - dry hole.

TP 205, ELEV. 656.1, 6+20, 95' U.S.

0.0 0.8 Topsoil, roots, etc.  
0.8 6.5 Clay, gravelly and sandy; lt. brn, moist, trace of small cobbles (max. size 4") 25% gravel, 15% sand, 60% plastic fines, coarse particles are durable, angular chert and sandstone fragments.  
6.5 7.5 Gravel, sandy and clayey; brn, moist, 40% gravel, 25% sand, 35% plastic fines, coarse particles are nondurable, angular shale fragments.  
7.5 8.5 Siltstone, gry-brn, moderately soft, slightly liney excavates as cobbles (max. size 12")  
8.5 Bottom of pit - dry hole.

TP 206, ELEV. 648.0, 6+65, 190' U.S.

0.0 0.8 Topsoil, roots, etc.  
0.8 10.5 Clay, gravelly and sandy; lt. brn, moist, trace of small cobbles (max. size 6"), 30% gravel, 15% sand, 55% plastic fines, coarse particles are angular and durable.  
10.5 Bedrock Bottom of pit - dry hole.

Dr 207, ELEV. 660.7, 5+75, 180' U.S.

Logged by: D. C. Olson 8/14/66

Drilling Equipment: Sprague, Woodward 30"

Hole Depth	From To	Description of Materials	Soil Class	Soil Type	Used	Notes	No.
0.0	1.5	Topsoil, roots, etc.	CL	Sp7		11-12-2	1
1.5	9.5	Clay, gravelly and sandy; brn, moist, 20% gravel, 15% sand, coarse particles angular and durable.	CL	Sp7		11-11-14-12	2
						11-11-14	3
						11-11-25-43	5
5.5	19.0	Shale, weathered, gry-brn, moist, slightly	CL	Sp7			
19.0	17.0	Shale, weathered lt. gry					
		with many brn stains, mostly moderately soft with some soft pieces, latest piece of core is 3.1' long, many gravel size pieces.					
17.0	25.0	Siltstone, lt. gry, moderately soft, pieces of core up to 0.6' long, average size about 0.2'. A few gravel size pieces dip = 35°					
25.0		Bottom of Boring WL (3/15/66) 12.3'					

TP 201, ELEV. 559.5, 6+40, 210' D.S.

0.0 1.2	Topsoil (plow-layer) roots, etc. not very organic	
1.2 6.5	Clay, sandy and gravelly; lt. brn, moist, trace of cobbles, (max. size 6") CL	
6.5 11.5	15% gravel, 20% sand, 65% very plastic fines, coarse particles are angular sandstone, chert and some shale, durable for the most part. GP	
11.5	Shale, weathered, gray with many other colors present, excavates as gravel and sand and trace of plastic fines, moist, 50% platy gravel, 50% platy sand, particle strength soft, definitely nondurable, excavates easily with backhoe.	
11.5	Bottom of pit - shale dips about 45° downhill - Dry hole	

TP 202, ELEV. 546.6, 7+70, 245' D.S.

		SAMPLES		From To		%
		No.	Type	Ft.	Ft.	
0.0 0.7	Topsoil, roots, etc.					
0.7 6.0	Clay, sandy and gravelly; lt. brn, moist, 15% gravel, 20% sand, coarse particles are soft to very soft, angular, nondurable shale fragment, some coarse particles are lumps of shale that can be crushed to a CL in fingers. (CL)	1	1504	1.0	6.0	
6.0 11.0	Shale, highly weathered, soft, brn, moist, excavates as a GC with a trace of cobbles, 40% gravel, 25% sand, 15% plastic fines, coarse particles are angular and soft to very soft, nondurable. GC					
11.0 12.0	Shale, weathered, slightly harder than the shale described above, brn with black stains in bedding planes. GP					
12.0	Bedding is contorted but generally dip downhill at about 55°. Bottom of pit - dry hole.					

TP 203, ELEV. 551.8, 7+00, 160' D.S.

0.0 0.8	Topsoil, roots, etc.	
0.8 6.0	Clay, sandy and gravelly; lt. brn, moist, 15% gravel, 20% sand, 45% plastic CL	
6.0 9.5	Shale, highly weathered, soft, brn, moist, excavates as a GC with a trace of cobbles, 40% gravel, 25% sand, 15% plastic fines, coarse particles are soft to very soft, angular nondurable. GC	
9.5 10.5	Shale, weathered, soft, gray-brn with black stains in bedding planes, moist GP	
10.5	excavates as small cobbles and gravel, 50% each with a trace of sand and fines.	
10.5	Bottom of pit - dry hole.	

TP 204, ELEV. 552.9, 0+80, Centerline

0.0 0.8	Topsoil, roots, etc.	
0.8 6.5	Clay, gravelly and sandy; lt. brn, moist, 25% gravel, 20% sand, 55% plastic CL	
6.5 8.5	plastic fines, coarse particles are angular, durable chert and sandstone. Siltstone, weathered, limestone in top 1.0', slightly limy below 7.5', GP	
8.5	excavates as cobbles (max. size 11") gray-brn.	
8.5	Bottom of pit - dry hole.	

TP 205, ELEV. 550.0, 0+20, 25' D.S.

		SAMPLES		From To		%
		No.	Type	Ft.	Ft.	
0.0 0.8	Topsoil, roots, etc.					
0.8 6.5	Clay, gravelly and sandy; lt. brn, moist, trace of small cobbles (max. size 6") 25% gravel, 15% sand, 10% plastic fines, coarse particles are durable, angular chert and sandstone fragments. CL					
6.5 7.5	Gravel, sandy and clayey; brn, moist, 10% gravel, 25% sand, 15% plastic fines, coarse particles are nondurable, angular shale fragments. GC	1	1505	6.5	7.5	
7.5 8.5	Siltstone, gray-brn, moderately soft, slightly limy GP					
8.5	excavates as cobbles (max. size 12")					
8.5	Bottom of pit - dry hole.					

TP 206, ELEV. 548.0, 0+65, 100' D.S.

0.0 0.8	Topsoil, roots, etc.	
0.8 10.5	Clay, gravelly and sandy; lt. brn, moist, trace of small cobbles (max. size 6"), 15% gravel, 15% sand, 55% plastic CL	
10.5	plastic fines, coarse particles are angular and durable, bedrock. Bottom of pit - dry hole.	

TP 207, ELEV. 540.7, 5+75, 140' D.S.

Logged by: G. C. Johnson 3/15/66

Drilling Equipment: Sprague & Henwood 30C

Hole Depth From To	Description of Materials	Unif. Soil Class	Type	STANDARD PENETRATION		SAMPLES		
				Used	Blows Per 6"	No.	Type	%
0.0 1.5	Topsoil, roots, etc.	SPt	1-1-2-2	1	Jar	0.0	2.0	95
1.5 3.5	Clay, gravelly and sandy; lt. brn, moist, 20% gravel, 15% sand, coarse particles are angular and durable. CL		1-4-7-8	2		2.0	6.0	65
3.5 5.5	brn, moist, 20% gravel, 15% sand, coarse particles are angular and durable. CL		11-13-14-12	3		4.0	6.0	75
5.5 10.0	Shale, weathered, gray-brn, slightly moist, soft. CL		1-8-11-10	4		6.0	8.0	40
10.0 11.0	Shale, weathered, gray-brn, slightly moist, soft. CL		11-13-25-03	5		8.0	10.0	80
11.0 12.0	Shale, weathered lt. gray with many brn stains, mostly moderately soft with some soft pieces, largest piece of core is 0.1' long, many gravel size pieces. GC					10.0	14.0	80
12.0 13.0	Siltstone, lt. gray, moderately soft, pieces of core up to 0.2' long, average size about 0.2'. A few gravel size pieces dip = 15°. GC					14.0	18.0	100
13.0 14.0	Siltstone, weathered, moderately soft, gray with brn stains in bedding planes, largest piece of core is 0.2' long, many gravel size pieces. GC					18.0	21.0	100
14.0 15.0	Siltstone, gray, moderately soft, pieces of core up to 0.3' long, average 0.1-0.2'. Same as above with pieces up to 1.1' long and average about 0.5', moderately soft to moderately hard. GC					21.0	24.0	100
15.0 16.0	Bottom of boring - (3/15/66) 12.3'					24.0	25.0	95

All stations are referenced to the baseline.

See note on sheet 29.

TP 208, ELEV. 562.0, 6+00, Centerline

Logged by: G. C. Johnson 3/14/66

Drilling Equipment: Sprague & Henwood 30C

Hole Depth From To	Description of Materials	Unif. Soil Class	Type	STANDARD PENETRATION		SAMPLES		
				Used	Blows Per 6"	No.	Type	%
0.0 1.5	Topsoil, roots, etc.	SPt	0-0-0-3	1	Jar	0.0	2.0	45
1.5 16.0	Clay, silty, sandy & gravelly lt. brn, moist (weathered shale), 15% gravel (moderately hard shale) 15% fine sand. CL		4-5-5-5	2		2.0	4.0	40
16.0 18.0	Shale, brn and gray, moist, weathered mostly gravel size pieces in a CL matrix, pieces range from very soft to moderately soft. GC		10-7-5-6	4		4.0	6.0	55
18.0 19.0	Shale, weathered, olive moderately soft, core is in 5 pieces ranging from 0.1-0.3' long with some sand, gravel and clay. Same as from 14.0-16.5'		4-5-5-5	5		6.0	10.0	35
19.0 22.0	About the same as from 16.5-18.0, dip = 45° GC		5-5-5-10	6		10.0	12.0	95
22.0 25.0	Shale, black, moderately soft, pieces of core up to 0.5' long, bottom 1.0' is more gray and brn. GC		11-16-21-18	7		12.0	14.0	45
25.0	Bottom of boring - (3/15/66) 11.2' - (3/16/66) 11.8'					14.0	19.0	40
						19.0	22.0	100
						22.0	25.0	100

TP 209, ELEV. 563.0, 5+65, 125' D.S.

Logged by: G. C. Johnson 3/15/66

Drilling Equipment: Sprague & Henwood 30C

Hole Depth From To	Description of Materials	Unif. Soil Class	Type	STANDARD PENETRATION		SAMPLES		
				Used	Blows Per 6"	No.	Type	%
0.0 1.0	Topsoil, roots, etc.	SPt	0-0-1-0	1	Jar	0.0	2.0	5
1.0 16.0	Clay, sandy and gravelly; brn, moist, 20% gravel, 15% sand, 65% plastic CL		5-5-1-12	2		2.0	4.0	40
16.0 20.5	Shale, same as above but with moderately hard zones up to 0.3' Siltstone, slightly weathered, gray with brn, pieces of core up to 0.2' long, average about 0.4', some gravel size pieces and a few clay lumps, rock is moderately soft. GC		10-9-9-9	3		4.0	6.0	95
20.5 25.0	Shale, same as above but with moderately hard zones up to 0.3' Siltstone, slightly weathered, gray with brn, pieces of core up to 0.2' long, average about 0.4', some gravel size pieces and a few clay lumps, rock is moderately soft. GC		8-7-9-9	4		6.0	8.0	90
25.0	Bottom of boring - (3/16/66) 3.5'		13-11-11-17	5		8.0	10.0	95
			10-9-11-13	6		10.0	12.0	75
			7-8-16-24	7		12.0	14.0	45
			21-35-26-48	8		14.0	16.0	40
						16.0	20.5	95
						20.5	25.0	85

TP 210, ELEV. 576.0, 5+30, Centerline

Logged by: G. C. Johnson 3/15/66

Drilling Equipment: Sprague & Henwood

Hole Depth From To	Description of Materials	Unif. Soil Class	Type	STANDARD PENETRATION		SAMPLES		
				Used	Blows Per 6"	No.	Type	%
0.0 0.8	Topsoil, roots, etc.	SPt	1-1-2-2	1	Jar	0.0	2.0	40
0.8 3.0	Clay, sandy and gravelly; lt. brn, moist, 20% gravel, 15% sand, coarse particles are durable. CL		4-5-5-5	2		2.0	4.0	40
3.0 11.8	Shale, weathered, gray-brn, slightly moist, soft. CL		7-5-5-7	3		4.0	6.0	65
11.8 13.0	Shale, weathered, gray-brn, slightly moist, soft. CL		8-10-12-14	4		6.0	8.0	75
13.0 14.0	Shale, weathered, gray-brn, slightly moist, soft. CL		1-1-1-1-18	5		8.0	10.0	50
14.0 15.0	Clay, sandy & gravelly; gray-brn, moist (weathered shale), 10% fine gravel (moderately soft shale), 15% sand, becomes grayer with depth. GC		1-2-1-2-45/0.3'	6		10.0	11.8	40
15.0 23.0	Siltstone, gray, moderately soft, pieces of core up to 0.3' long, average 0.1-0.2'. Same as above with pieces up to 1.1' long and average about 0.5', moderately soft to moderately hard. GC					11.8	15.1	40
23.0 35.0	Bottom of boring - (3/15/66) 6.5'					15.1	18.0	100
35.0 36.0						18.0	21.2	100
36.0 37.0						21.2	24.6	100
37.0 38.0						24.6	35.0	100

MIDDLE CREEK WATERSHED	
MULTIPLE PURPOSE DAM PA-637	
SNYDER COUNTY, PENNSYLVANIA	
LOGS OF DRILL HOLES AND TEST PITS	
U. S. DEPARTMENT OF AGRICULTURE	
SOIL CONSERVATION SERVICE	
Date: 3-28-66 Drawn by: [Signature] Checked by: [Signature] Title: [Blank] Date: 3-28-66	Approved by: [Signature] Title: [Blank] Date: 3-28-66 PA-637-P

L. ROBERT KIMBALL & ASSOCIATES  
CONSULTING ENGINEERS & ARCHITECTS

FIGURE 16

APPENDIX F

GEOLOGY

### General Geology.

Middle Creek Dam lies in the Valley and Ridge Physiographic Province as described by Fennemann (1938). This province is typified by anticlinal and synclinal features with associated thrust faulting. Structurally, the dam lies in a synclinal trough between two anticlines. There is no major faulting in the area. The dam is situated in the midst of Lower and Middle Devonian aged rocks. A north-eastward trending, low, linear ridge lies to the south of the valley which encompasses Middle Creek Dam. The ridge is formed by resistant sandstones of the Mahantango Formation. This formation is underlain by the Marcellus and Onondago Formation which underlie the dam and form the valley of the North Fork of Middle Creek. These formations are underlain by the Oriskany Formation. The Ridgely Member of this formation is a highly resistant sandstone and forms the ridges lying to the north of the dam.

The dam is directly underlain by the Marcellus Formation and the Onondago Formation. The Marcellus Formation is a black fissile carbonaceous shale with a thick brown sandstone (Turkey Ridge). The Onondago Formation includes interbedded blue shales and dark blue to black cherty limestones.

AD-A070 834

KIMBALL (L ROBERT) AND ASSOCIATES EBENSBURG PA

F/G 13/2

NATIONAL DAM INSPECTION PROGRAM. MIDDLE CREEK DAM, CLARENCE F. --ETC(U)

APR 79

DACW31-79-C-0009

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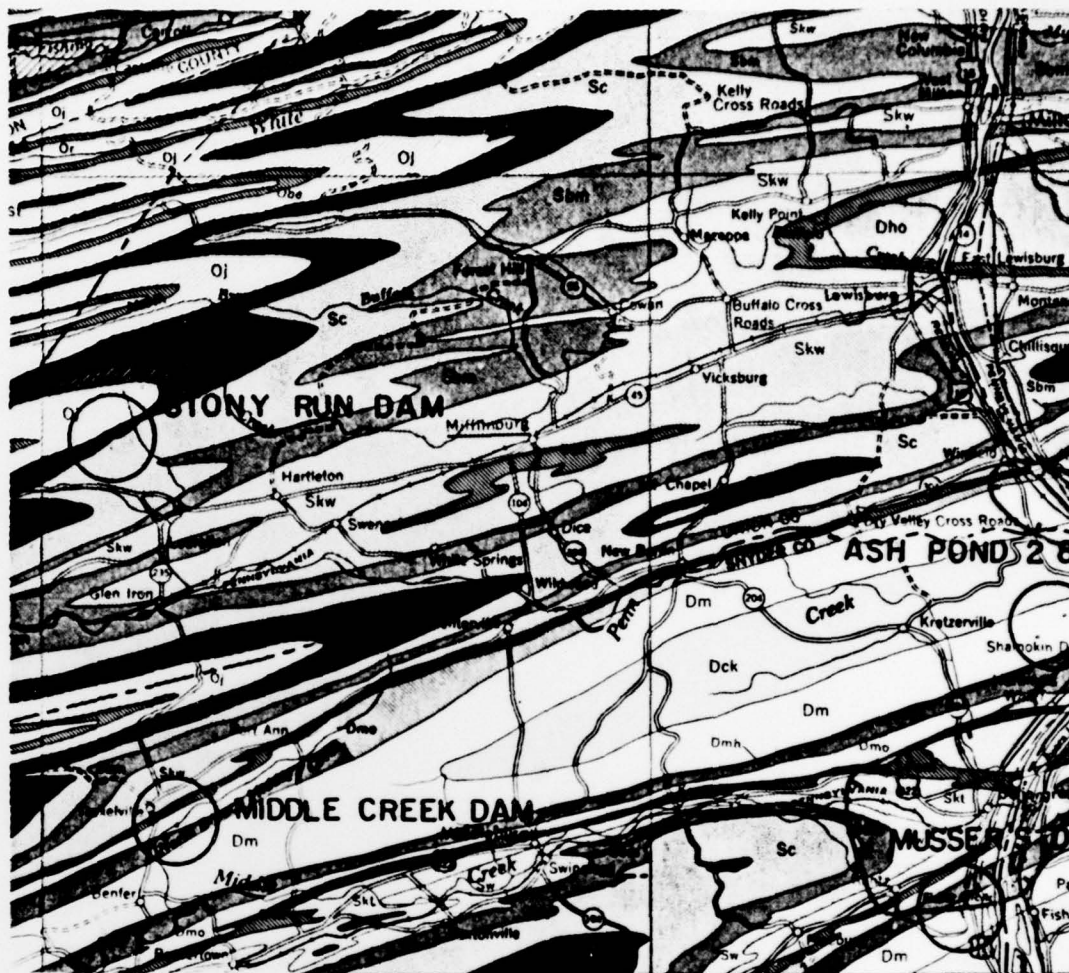


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Geologic Map of: Stony Run, Middle Creek, Ash Ponds 2 and 3, and Musser's Dam Sites

SCALE: 1:250,000



**Marine beds**

Gray to olive brown shales, graywackes, and sandstones, contains "Chemung" beds and "Portage" beds including Hurket, Brallier, Havrell, and Trimmers Rock. Tully Limestone at base.



**Marcellus Formation**

Black, fissile, carbonaceous shale with thick, brown sandstone (Turkey Ridge) in parts of central Pennsylvania.

**Onondaga Formation**

Greenish blue, thin bedded shale and dark blue to black, medium bedded limestone with shale predominant in most places, includes Selinagrace Limestone and Needmore Shale in central Pennsylvania and Buttermilk Falls Limestone and Enopus Shale in easternmost Pennsylvania, in Lehigh Gap area includes Palmerston Sandstone and Roumanstown Chert.



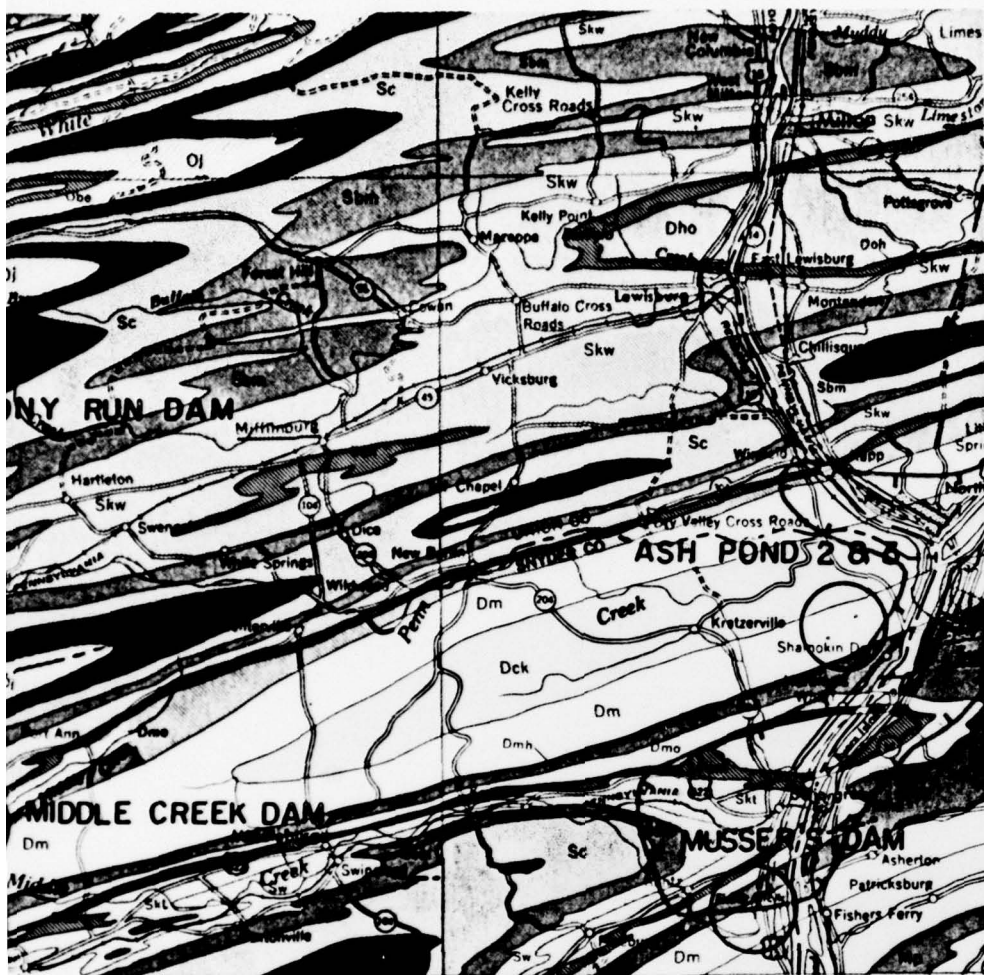
**Clinton Group**

Predominantly Rose Hill. Reddish purple to greenish medium bedded, fossiliferous, intertonguing iron ore local gray, fossiliferous like the Rose Hill is brown to sandstone (Kiefer) intertonguing with dark gray shale (Rock).



**Tuscarora Formation**

White to gray, medium to fine grained, quartzitic, glomeratic in part.



Geologic Map of: Stony Run, Middle Creek, Ash Ponds 2 and 3, and Musser's Dam Sites

SCALE: 1:250,000

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brown shales, graywackes,  
etc. contains "Chemung" beds  
etc. beds including Hurket,  
orell, and Trimmers Rock,  
one at base.

#### Formation

etc., carbonaceous shale with  
sandstone (Turkey Ridge) in  
val Pennsylvania.

#### Formation

etc., thin bedded shale and dark  
etc., medium bedded limestone  
predominant in most places,  
usque Limestone and Need-  
in central Pennsylvania and  
Falls Limestone and Esopus  
westernmost Pennsylvania, in  
area includes Palmetton  
and Rowmantown Chert.

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#### Clinton Group

Predominantly Rose Hill Formation -  
Reddish purple to greenish gray, thin to  
medium bedded, fossiliferous shale with  
interfingering "iron sandstones" and  
local gray, fossiliferous limestone, above  
the Rose Hill is brown to white quartzitic  
sandstone (Kretzer) interbedded upward  
with dark gray shale (Rockester).

#### Tuscarora Formation

White to gray, medium to thick bedded,  
fine grained, quartzitic sandstone, con-  
glomeratic in part.